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Papers on child language development include: "Sentence Frame Effects on Children's Category Judgments" (Alison K. Adams); "Color Similarity in Children's Classifications and Extension of Object Labels" (Dare Baldwin); "Situational Properties of Early Verb Meaning" (Pol Cuvelier); "Similarity, Specificity, and Contrast: A Study of Early Semantic Categories" (Esther Dromi, Gil-li Fishelzon); "The Role of Correction in Language Acquisition" (Cheryl R. Garcia, Jeri J. Jaeger); "Understanding Natural Kind Terms: A Developmental Comparison" (Susan A. Gelman, Ellen M. Markman); "Children's Sensitivity to the Contrastive Use of Object Category Terms" (Jean E. Hutchinson); "Acquisition of Quantificational Scope in Mandarin Chinese" (Thomas Hun-Tak Lee); "The Assignment of Sentence Accent and Contrastive Stress by Two 28-Month-Old Twins" (Claudia A. Mazzie); "Distinguishing Effects of Parameters in Early Syntax Acquisition: A Crosslinguistic Study of Japanese and English" (Reiko Mazuka, Barbara Lust, Tatsuko Wakayama, Wendy Snyder); "At the Crossroads of Phonology and Discourse: Structure and Function in a One-Year-Old's 'Conduites d'approche'" (Kurt Queller); and "Color Word Acquisition: Conceptual or Linguistic Challenge?" (Nancy N. Soja). (MSE)

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ON

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Editors' Note

This issue of *Papers & Reports on Child Language Development* contains the proceedings of the eighteenth annual Child Language Research Forum, held at Stanford, April 4-6, 1986. We would like to thank all the members of the CLRF committee whose hard work made the Forum possible; Steven Pinker for giving the Keynote Address; Stan A. Kuczaj II, Lise Menn, and Ann Peters for organizing and leading Special Interest Groups; and the participants who contributed so much to making the meeting a success.

Next year's Forum will be on **April 3-5, 1987**; it will be coordinated by Gary Holden. Abstracts (limit 250 words) will be due on January 10, 1987. Abstracts and enquiries should be addressed to Coordinator/CLRF-87, Department of Linguistics, Stanford University, Stanford, CA 94305.

August 1986

Eve V. Clark
Sharon Inkelas
Melissa Moyer

PRCLD 25
(1986)

Sentence Frame Effects on Children's Category Judgments

Alison K. Adams
University of Hawaii

Research on categorization, and the influence of object typicality on categorization processes, can be informed by Vygotsky's ideas regarding socialized aspects of thinking. The present research questions the"pre-linguistic concept" view of concept development that has dominated a good deal of the research in this area (Schlesinger, 1982). From this perspective, children's early concepts and categories are constructed through a process of spontaneous invention. On the other hand, the influence of individual environmental experience and interactive context recently has begun to make it's way into our theories of concept development. However, the importance and nature of the ways in which concept development and category evolution are socially guided have continued to be neglected.

The problem is that our thinking about categorization has been dominated by an unfortunate legacy of Piagetian theory: the "Child as Mini-Scientist" view of cognitive development. Children are thought to construct basic concepts, categories, and complex ideas in relative isolation. The application of this scientist metaphor to the realm of concept development is unsatisfying, because it fails to answer a very important question. How do children's idiosyncratic experiences somehow ultimately result in a representational network that is shared by children and adults? What variables and processes account for the fact that each child's categories evolve to match a cultural standard? The answer is both simple and complex. The simple part is to claim that someone teaches us these things. The difficult part is to understand what collection of activities, abilitites, strategies, and predispositions underlies teaching.

In order to reconceptualize concept development and category evolution as processes involving learning, we need to abandon the child-as-scientist model and adopt a new metaphor. An alternative is the idea of "the child as apprentice" (Kaye, 1982). Children are apprenticed into the culture, and apprenticeship is a socially distributed process involving an expert and a novice. The outcome of an apprenticeship depends on the skills and intrinsic capabilities of the teacher, as well as those of the learner.

We can think about some aspects of development in terms of convergence on an adult standard. In the case of semantic development, children are converging on a conventional representational network -- one that is functionally equivalent to that of adults. Practically speaking, they end up using words and ideas very much as others do. In short, they are apprenticed into the ways of speaking and thinking of their culture.

Consider the conventional organization of a category like BIRD. The category contains both central and peripheral members. Typical members of the category are commonly labeled "bird", unless the context calls for a more specific label. Atypical members of the category are commonly labeled with specific names, like "penguin" or "turkey", unless the context requires identification of the exemplar's taxonomic category membership (see Adams & Bullock, 1986). Generally speaking, this is the conventional organization of the category for adults in our society.This is an important point, because an apprenticeship model of development works best if you are able to specify the target of that developmental process (Adams, 1985). Presumably, parents do have some kind of target pattern in mind as they go about shaping and correcting children's patterns of labeling.

A child may have an unconventional BIRD category. His category includes some of the things adults call "Bird", but also includes bats. Somehow, the parent has to help the child separate the birds from the bats. "Duck" for this child may be an independent category -- it needs to be integrated into BIRD. "Penguin" may need to be disembedded from a SEAL category and then integrated into BIRD. "Turkey" and "chicken" may need to be cross-listed as both meats and birds. BIRD itself eventually will need to be differentiated into it's specific subtypes, like "crow", "robin", and so on (see Adams & Bullock, 1986). At the end of this process of category evolution the child's category will be organized in a more conventional manner. This process is socially guided; it is a social convergence process. Parents do things that lead to convergence of the child's idiosyncratic category on the conventional adult category.

What kinds of strategies do parents use to promote these changes? The first thing they do is **Label** and **Re-label** objects. Certainly, there are numerous studies that have looked at patterns of parental word use and their relationship to children's patterns of word use. For research that treats labeling from a socially guided perspective, I refer you to Mervis's pioneering work in the area (Mervis, 1984) and to work by Adams and Bullock (1986) which examines shifts in labeling patterns in one-, two-, and three-year-old children from a

social convergence perspective. Both of these lines of research focus on developmental changes in labeling practices per se.

More complex strategies -- strategies that are introduced after basic labeling patterns have been established -- are used to create two different kinds of changes in children's categories. They help differentiate the category into its subordinate subtypes and integrate peripheral members into the core category. These devices are used to shape category boundaries, and their use varies in relation to the typicality of the object being discussed. These "linguistic tools" are diverse, but in this research fall into four major groups. First are **Anchors** ("Dalmatian-dog"), where the introduction of a new label is linked to the old, previously established label (see also Clark et al., 1985). Second are **Modifiers** or modifying phrases ("spotted dog" for Dalmatian or "striped horse" for zebra), which modify the basic label and may form a bridge until the acquisition of a more phonologically complex subordinate level name is within the child's grasp. Third are **Statements of Class Inclusion** ("A penguin belongs to the bird family"), where the taxonomic category membership of the exemplar is specifically identified. Fourth are **Hedges** ("A penguin is a funny kind of bird" or "A zebra is sort of like a horse"), which acknowledge the non-transparent nature of the relationship between atypical exemplars and their conventional categories (see Lakoff, 1972, for work on adults' use of hedges).

Figures 1 and 2 show the distribution of maternal use of these linguistic devices in relation to exemplar typicality. Generic exemplars are non-descript -- the everyday dog or cat that may not have a proper subordinate level name. Typical exemplars are exemplars which have a specific subordinate level name -- like "bluejay" or "robin"-- which may or may not be selected on a particular occasion. Atypical exemplars are those which are peripheral to the category. They are generally labeled with their subordinate level names unless circumstances require some identification of taxonomic family membership.

These data are from an investigation which examined labeling patterns in middle-class mother-child dyads reading picture books. The children were 1, 2, and 3 years old and the objects they labeled were members of different animal categories (BIRD, DOG, CAT, DEER, BEAR, HORSE). Although these data have been collapsed across all three age groups, maternal use of these forms increases in frequency with the age of the child. Here the point is simply to illustrate that the use of the four sentence frames does indeed vary a function of exemplar typicality. They were very rarely used in conjunction with generic exemplars, where simple labels suffice. For typical exemplars, the use of

FIGURE 1

EFFECTS OF EXEMPLAR TYPE ON
MOTHERS' PROPORTIONAL USAGE OF LINGUISTIC FORM
(Study 1)

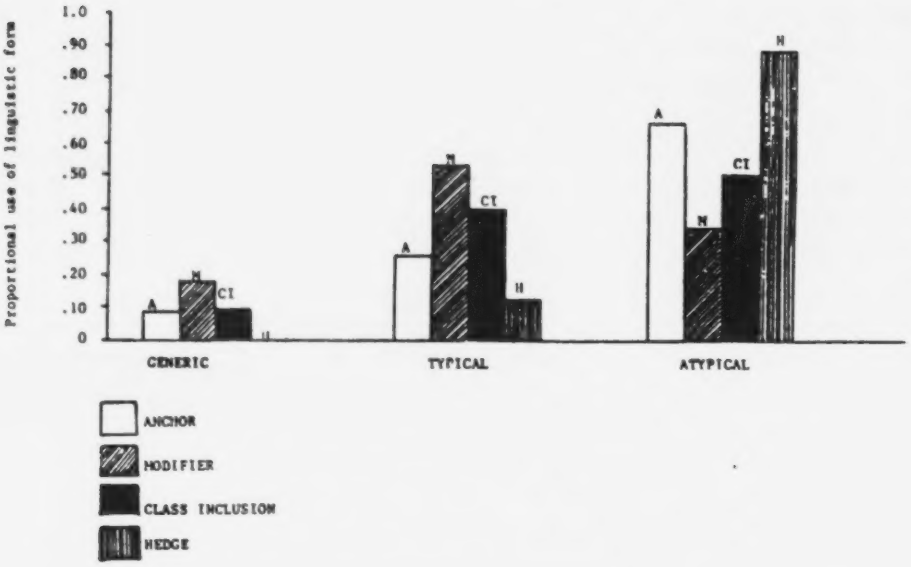
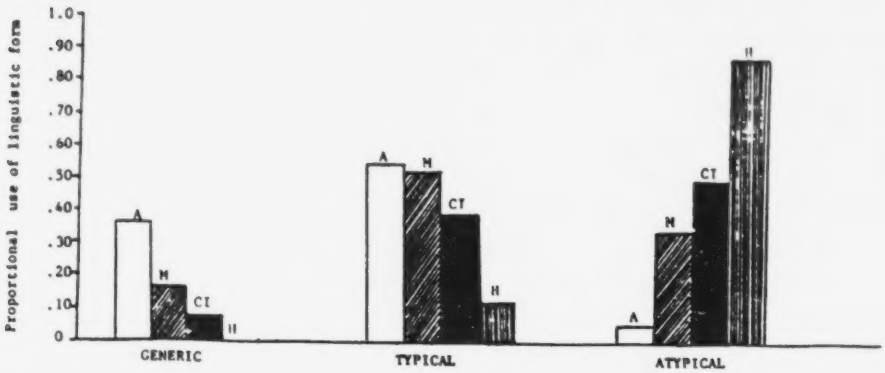


FIGURE 2

EFFECTS OF EXEMPLAR TYPE ON MOTHERS'
PROPORTIONAL USAGE OF LINGUISTIC FORM, ANCHORED BEARS REMOVED
(Study 1)



modifiers and statements of class inclusion was relatively high. The most common class inclusion statement for examplars of this sort was a "kind of" construction ("A robin is a kind of bird"). For Atypical exemplars, the relative use of these forms also was quite high. The change in the use of Hedges was quite significant -- they were used almost exclusively in relation to peripheral members of the categories.

The use of anchors is somewhat more complex. The high use of anchors for atypical exemplars in Figure 1 is in some ways an artifact. It was created almost entirely by the use of routinized phrases used in relation to members of the category BEAR. These are phrases, like "panda bear", "polar bear", and "koala bear"; there was neither reliable nor deliberate use of phrases like "penguin bird". This anchoring of atypical exemplars occurred only in relation to this category, and was incorrect in 2/3 of the cases and inevitable in the third (pandas and koalas aren't bears and the word "polar" only refers to bears when it's anchored). Thus,whether they should be considered deliberate teaching strategies is called into question. When the anchored bears are removed from the analysis the pattern of results shifts to that shown in Figure 2. Here, the proportional use of anchors occurred in relation to typical exemplars. Their occasional use in relation to generic exemplars occurred when mothers invented anchored names for these animals, imposing labels like "bay horse".

These results clearly establish that mothers spontaneously use these devices when speaking to children in a naturalistic educational setting. However, they cannot determine whether or not there is a relationship between maternal use of these forms and the development of children's categories. It's possible that children are not able to make use of the subtle distinctions in degree of category membership marked by these different sentence frames. The next study was designed to look at the effects of these forms on children's category judgments.

The second study was a mini-longitudinal study of mothers and their children, who were 3 years, 8 months old and came from middle class families in Denver, Colorado. Thirty-two dyads were randomly assigned to two picture book reading conditions, although for the purposes of this discussion, the data from these two conditions have been combined. The books themselves contained 36 colored drawings of animals from the same six categories used in Study 1. As in the previous study, these exemplars represented a range of typicality: Generic (highly typical), Typical, and Atypical. All children were pre- and post-tested on two measures of cognitive organization: (1) a card sorting task and (2) a sentence acceptance task. The pre- and post-test sessions

were separated by two weeks of at-home book reading. The results of the sentence acceptance task are of primary interest here (see also Adams, 1985).

The sentence acceptance task was a modified version of the standard sentence verification paradigm often used to assess levels of syntactic development. The child and an experimenter play a game with puppets in which the child is asked to judge the whether or not a particular utterance is acceptable and correct it if it is not. Here the task was used to assess category structure using those same sentence frames identified in the prior study: Hedges, Anchors, Modifiers, and Statements of Class Inclusion.

A subset of the animals appearing in the books was selected for the sentence acceptance task. These animals were both the most typical (and nameable) animals and the most atypical animals from each category, and were selected according to typicalty ratings obtained from a group of 10 adult raters. Thus, the typical animals appearing in the set were a robin, a Siamese, a collie, a palomino, an elk, and a grizzly. The atypical animals included were a penguin, a leopard, a Pekingese, a zebra, a moose, and a panda. There were 42 sentences in all. Six of these were warm-up sentences, and half of those remaining were distractor sentences, leaving a target set of 18 sentences. Linguistic frame was crossed with exemplar typicality for all portions of the set. For example, an Identity/Typical Sentence would be, "A robin is a bird"; an Identity/Atypical sentence would be, "A penguin is a bird". An Anchored/Typical sentence = "A Siamese-cat is a cat"; and Anchored/Atypical = "A leopard-cat is a cat". (Note that we have introduced anchors in relation to atypical exemplars, even though they did not spontaneously occur in this context in Study 1 --except in relation to bears). A Class Inclusion/Typical sentence = "A collie belongs to the dog family"; Class Inclusion/Atypical = "A Pekingese is a kind of dog". For Hedges, we excluded the Hedge/Typical condition, in part in an attempt to restrict the size of the set, which was becoming unmanageable for the children, and in part because sentences like "A robin is a funny sort of bird" are fairly odd themselves. Each sentence judgment was introduced with a picture of the target exemplar and the statement, "This is an X", followed by the specific test sentence (e.g., "This is a penguin. A penguin is a bird.")

The results showed that judgments of category membership for typical members of each category were virtually perfect for all sentence frames during both assessments. This means that the relative ease of making judgments or drawing inferences about category membership was affected by object typicality. When exemplars were typical, judgments were relatively easy and

insensitive to particular linguistic frame. This result is not surprising, given that the relationship of typical exemplars to their category is more conceptually transparent. Typical category members are the empirical base from which the child constructs the basic level category.

All effects for the sentence acceptance task were due to changes in children's willingness to include atypical exemplars in the category --that is, to judge sentences with atypicals as correct. In other words, convergence on the conventional category took the form of integrating peripheral members into the taxonomic category. More specifically, analyses of variance yielded the following pre- to post-test changes in children's membership judgments, by sentence frame. Changes in judgments of simple Identity sentences were only marginally significant ($p < .06$). Thus, children were only slightly more likely to include peripheral members in the core category when the relationship was posed as one of simple identity. There was no effect of training (i.e., no convergence) in Modifier sentences. Convergence in judgments involving Anchors jumped dramatically ($p<.001$) over the two week period. Children were much more willing to accept sentences like "A leopard-cat is a cat" during the second session. Thus, anchored phrases may be an effective strategy for teaching the category membership of peripheral members, even though it occurred very rarely in Study 1 (with the exception of the category BEAR). Statements of Class Inclusion also were far more likely to be accepted during the second session ($p<.01$). Hedges showed a highly significant jump in acceptance rate between the two sessions ($p<.001$), meaning that children who originally rejected sentences like "A penguin is a funny sort of bird" were far more willing to accept them after two weeks of picture book reading.

In sum, the results show large effects of Anchors, Class Inclusion Statements, and Hedges in judgments of category membership. There were marginal or no effects for Identity and Modifier sentences. This pattern of results is significant for two reasons. First, it shows that children are sensitive to the semantic information carried by these linguistic forms. They are able to use them to make category boundaries more flexible, as do adults. Thus, when helped by linguistic form, even three year old children may not be the dichotomous thinkers we so often accuse them of being. Second, the results show that for these children much of the change in category structure in this task involved integration of atypical members of the category into the conventional category, when the technical or tangential nature of that relationship was implicity acknoweledged by sentence frame. While

differentiation in naming practices for typical exemplars may also have been occurring (Adams & Bullock, 1986), this differentiation of the category into its subtypes does not necessarily reflect changes in understanding taxonomic organization per se. However, the transformation of a basic level category into a category that includes peripheral members may well set the stage for building a later understanding of class inclusion relationships.

In conclusion, I have argued that concept formation is a socially guided process involving convergence on an adult model.Convergence in labeling is an early strategy for shaping children's category boundaries. Later more elaborate linguistic means are used to differentiate and integrate members of categories. These devices include constructions like anchors and hedges, and serve a social function in that they are used to teach conventional category organization. The results of the sentence acceptance task show that children are able to use this information and that convergence on the adult network is sensitive to this measure. By constraining the use of these devices during the teaching period, it may be possible in future research to test for a clear relationship between individual differences in parental use of these devices and variations in children's cognitive development.

Adams, A. K. (1985). Learning animal taxonomies: Social convergence processes in reorganizations of semantic networks. Unpublished doctoral dissertation, University of Denver.

Adams, A. K. & Bullock, D. (1986). Apprenticeship in word use: Social convergence processes in learning categorically related nouns. In S.A. Kuczaj and M.D. Barrett (Eds.), The development of word meaning. New York: Springer-Verlag.

Clark, E.V., Gelman, S.A., & Lane, N.M. (1985). Compound nouns and category structure in young children. Child Development, 56, 84-94.

Kaye, K. (1982). The mental and social life of babies. Chicago: University of Chicago Press.

Mervis, C.B. (1984). Early lexical development: The contributions of mother and child. In C. Sophian (Ed.), Origins of cognitive skills. Hillsdale: Erlbaum.

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Color Similarity in Children's Classifications and Extension of Object Labels

Dare A. Baldwin
Stanford University

One task young children devote considerable energy to is that of learning names for objects and object classes, such as *dog* and *ball*. Moreover, this is one endeavor in which young children display considerable skill -- they learn many such object labels early and rapidly. This is not to say, however, that children's learning of object labels is completely error-free. At early ages, children make some striking mistakes in their use of object labels. For instance, young children frequently overextend a label to objects for which adults would not use the label. An example of this is when a child uses the label *ball* to refer to oranges and doorknobs as well as balls.

The overextension errors children make are interesting because they seem to disclose children's expectations for how object labels will package the object world. It is revealing, for instance, that children frequently overextend a label to objects similar in form to the objects for which adults use the label (e.g., Clark, 1973; Nelson, 1974; Gentner, 1978; Tomikawa & Dodd, 1980). Such form-based overextension errors seem to suggest that very young children expect that object labels will refer to a class of objects that share similar forms.

Overextension errors are also revealing for their neglect of certain properties. That is, certain properties *never* seem to appear as the basis for children's overextension errors. Neglect of this kind suggests that children view the absent properties as irrelevant to the way that object labels group objects. One such neglected property of particular note is color: children never overextend object labels solely on the basis of shared color (Clark, 1973; Nelson, 1974). The present study was designed to demonstrate that children refrain from overextending labels on the basis of color precisely because they view color as relatively uninformative about the extension of object labels.

The absence of color as the basis for children's overextension errors is especially striking because young children frequently group objects together on the basis of color when performing standard classification tasks (e.g., Brian & Goodenough, 1929; Melkman, Koriat, & Pardo, 1976; Melkman, Tversky, & Baratz, 1981; Suchman & Trabasso, 1966). That is, children between the ages of about two and four will often choose to group objects that share only similar color (e.g., a *red apple* and a *red suitcase)* instead of grouping objects which share similar form but differ in color (e.g., a *red apple* and a *green apple)*. Children's interest in color at the expense of form wanes with development: by four or five years of age, children given such a classification task group objects almost exclusively on the basis of similar form rather than similar color.

It should be noted that young children's interest in color similarity as a basis for grouping objects fails to attain the status of an overwhelming preference, even when at its height. Nevertheless, the fact remains that they show *some* willingness to group objects that share only color. Children's apparent *unwillingness* to

generalize object *labels* solely on the basis of color similarity thus appears in stark contrast with their willingness to use color similarity for grouping objects in standard classification tasks. If reliable, this discrepancy would suggest that children avoid color when extending object labels not because it is uninteresting, but because they expect it to be irrelevant to the extension of these words.

Children may avoid extending labels solely on the basis of color for another reason: they may expect labels to refer to objects similar in form. This expectation would lead children to maximize form similarity in their extension of labels, and at the same time prevent them from extending labels to objects that share only color and not form. Considerable evidence already exists that children possess an expectation that object labels will group objects similar in form (e.g., Baldwin, 1985; Gentner, 1978; Markman & Hutchinson, 1984; Tomikawa & Dodd, 1980). However, we do not yet know whether children expect form similarity to be relatively more important than color similarity in the extension of object labels.

The analysis that I am offering here follows the same line of reasoning offered by Markman and Hutchinson (1984). They demonstrated that young children prefer to extend object labels to categorically related objects, even though children find thematic relations more salient than categorical relations when object labels are not involved. Based on this evidence, Markman and Hutchinson argue that children constrain labels to refer to categorically related objects, and therefore view thematic relations as irrelevant to the meanings of these words. I am suggesting that young children may possess similar early expectations concerning color and form similarity. Namely, children may expect form similarity to be more relevant than color similarity to the extension of object labels.

Children's reliance on an expectation that form is more relevant than color to object label extension would yield the pattern of overextension errors we see, and it would also help explain the relative speed and ease with which children learn object labels. "Form - relevant" and "Color - irrelevant" expectations should enhance children's acquisition of object labels for several reasons. For one thing, object labels across the world's languages show a marked tendency to group objects that are similar in form (e.g., Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). Moreover, color is not very important in the way that objects are grouped by object labels (cf. Quine (1969) for a related argument). This is easily observed by considering two facts: a) object labels at all levels of generality frequently refer to objects that are heterogeneous in color (e.g., *books, games, sweaters),* and b) information about the color of an object is not very helpful when trying to decide which label might apply to that object (e.g., knowing that an object is *yellow* is not especially valuable for deciding what to call that object, since it could be called such different things as a *canary,* a *raincoat,* or a *banana).* The critical point here is that form is highly predictive of an object's category membership, and hence the label it falls under, while color is not. If children have expectations about object label meanings that match these facts, their discovery of the correct referents of object labels will be greatly facilitated.

I investigated whether children expect color similarity to be less important than form similarity in object label extensions by means of the methodology created by Markman & Hutchinson (1984). This involved comparing how children sort

objects similar in either color or form in two different situations: a) when they are asked to extend a novel object label, and b) when no novel labels are offered and children are merely asked to group together objects that are alike. Young children should be willing to group objects by color similarity when novel labels are not involved. However, if children's extension of object labels is indeed guided by an expectation that form similarity will be more important than color similarity, they should be much less willing to sort objects similar only in color (and consequently more likely to sort by form similarity) when asked to extend a novel label to a new referent.

Method

Twenty two-year-olds (2;01 - 2;11, mean age = 2;6) and twenty three-year-olds (3;01 - 3:10, mean age = 3;4) participated in the study. Children were introduced to a puppet, who asked them to help in grouping pictures of objects to complete a "picture-book." Half of the children participated in a *No Label* condition. They were told that their job was to help the puppet put objects that are alike on the same page in the picture-book. First, children saw a target object (e.g., a *red apple)* while the puppet inquired "Do you see this one?" They were then presented with two choice objects (e.g., color choice: *red suitcase;* form choice: *green apple)* as the puppet asked "Can you find another one?" Children's selections were inserted into the picture-book beneath the target object, after which the puppet asked "How did you decide that this one was the other one?"

The other half of the children participated in a *Novel Label* condition involving nonsense labels such as *zom, mip,* and *fud.* As in the *No Label* condition, children in the *Novel Label* condition were asked to help the puppet put objects that are alike on the same page in the picture-book. However, these children were also told that the puppet sometimes spoke in puppet-talk, which meant that he used words they had never heard before, and that part of the game was to figure out what his words meant. Children were shown the target object as the puppet said, "This is a [novel label]. Can you say [novel label]?" They were then presented with the two choice objects while the puppet asked, "Can you find another [novel label]?" After inserting the child's selection in the picture-book, the puppet asked "How did you decide that this was the other [novel label]?"

Children in both the *No Label* and *Novel Label* conditions sorted ten object triads that pitted color similarity against form similarity. Table 1 shows the ten object triads used in the study.

Table 1

Stimuli Used in Determining Children's Matching Preferences

Target Object	Color Choice	Form Choice
green axe	green car	blue axe
green cabbage	green flashlight	red cabbage
green bird	green leaf	blue bird
blue table	blue jacket	brown table
brown squirrel	brown sock	black squirrel
orange carrot	orange umbrella	white parsnip
red apple	red suitcase	green apple
red butterfly	red drum	blue butterfly
yellow cheese	yellow key	orange cheese
yellow banana	yellow whistle	red/green plantain

Results and Discussion

Children's sorting performance was initially analyzed with a 2 X 2 ANOVA, which revealed a significant main effect of age, $F(1, 36) = 15.75$, $p < .001$, a significant main effect of labeling condition, $F(1, 36) = 10.32$, $p < .01$, and a significant age X labeling condition interaction, $F(1, 36) = 4.32$, $p < .05$. Follow-up analyses using Tukey's W procedure were conducted to discover the locus of the interaction effects. Table 2 reports the mean number of form choices children made in the two labeling conditions.

Table 2

Children's Sorting in the Presence and Absence of Novel Object Labels

(mean number of form choices out of ten)

Age	No Label Condition	Novel Label Condition
2 years	6.0 (= chance)	8.8 (> chance)
3 years	9.2 (> chance)	9.8 (> chance)

Note: N = 40

Looking first at children's sorting when no labels were involved, we see that two- and three-year-olds sorted objects differently, Tukey's $W(36) = 2.8$, $p < .01$. Two-year-olds who heard no labels frequently selected a color associate to match with the target: they chose on the basis of color similarity an average of four times out of the ten object triads. In contrast, three-year-olds who heard no labels neglected color similarity to sort almost entirely on the basis of form similarity. This developmental trend to focus more exclusively on form similarity as opposed to color similarity replicates previous findings (e.g., Brian & Goodenough, 1929; Melkman, Koriat, & Pardo, 1976; Melkman, Tversky, & Baratz, 1981; Suchman & Trabasso, 1966).

Differences also emerged between the sorting of two-year-olds who participated in the *Novel Label* condition and those who sorted without hearing novel labels, Tukey's $W(36) = 2.8$, $p < .01$. When two-year-olds were asked to discover a new referent of a novel label, they very frequently selected on the basis of form similarity. Thus two-year-olds who heard novel labels concentrated on sorting by form similarity much more often than two-year-olds who heard no novel labels. This effect of the novel labels on two-year-olds' sorting also generalized across the ten different object triads, matched pairs $t(9) = 7.80$, $p < .001$. In fact, two-year-olds were more likely to pick the form similarity choice in every one of the ten triads if the target was presented in conjunction with a novel label. In summary, two-year-olds in the present study showed much less interest in color when extending novel labels than when they sorted objects in the absence of labels. They treated form as relatively more important than color for guiding their extension of novel object labels.

Three-year-olds showed a high level of form sorting in both the *No Label* and *Novel Label* conditions. Although they showed slightly greater attention to form similarity when extending novel labels as opposed to when no labels were presented, this difference was not significant. Three-year-olds, then, devoted the majority of their attention to sorting objects on the basis of form similarity, regardless of whether they were engaged in discovering a new referent for a novel object label.

A somewhat different analysis was conducted to investigate further the impact of the novel labels on children's sorting performance. I examined how likely individual children were to show a preference for color or form choices in the case where they heard novel labels as opposed to when no labels were offered. Children were credited with a preference if they reached a criterion of seven choices of the same type out of the ten triads. The results of this analysis appear in Table 3 for the two-year-olds, and in Table 4 for the three-year-olds.

Let us first consider two-year-olds' sorting preferences when no labels were involved: we see that very few two-year-olds actually *preferred* to group by color as opposed to form. In fact, just as many two-year-olds displayed a form preference as displayed a color preference in the *No Label* condition. In contrast, not even a single two-year-old displayed a color preference when extending novel labels: every two-year-old who heard novel labels preferred to sort on the basis of form similarity. The preference data thus provide additional evidence that two-year-olds view form similarity as more relevant than color similarity to the task of discovering the referents of novel object labels.

Table 3

The Number of Children Demonstrating a Preference in the Presence and Absence of Novel Object Labels

(Preference = at least 7 choices of one type out of ten)

TWO-YEAR-OLDS

Choice Type	No Label	Novel Label
Color	3	0
Form	3	10
No Preference	4	0

The effect of the novel labels on children's sorting preferences was less dramatic in the case of the three-year-olds: only one additional three-year-old showed a form preference in the *Novel Label* condition relative to the *No Label* condition. However, any tendency that the novel labels had to increase three-year-olds' form-sorting would have been obscured by their overwhelming preference to sort by form even when no labels were involved. It seems noteworthy, nevertheless, that three-year-olds, like two-year-olds, were unanimous in preferring to sort on the basis of form similarity when they were engaged in discovering the referents of novel object labels.

Table 4

The Number of Children Demonstrating a Preference in the Presence and Absence of Object Labels

(Preference = at least 7 choices of one type out of ten)

THREE-YEAR-OLDS

Choice Type	No Label	Novel Label
Color	0	0
Form	9	10
No Preference	1	0

Concluding Remarks

To conclude, I would like to emphasize several implications of the present research. I have suggested that color is a relatively uninformative property with regard to objects' category membership. That is, noticing a color similarity between objects may not be very helpful in deciding whether those objects share membership in the same category. Form similarity, by contrast, appears to be especially predictive of objects' category membership: we can typically identify the category membership of an object with a high degree of accuracy by noting its similarity in form to other objects whose category membership is known.

When children as young as two are engaged in learning object labels that refer to object categories, they demonstrate a marked tendency to ignore similarities of color in favor of attending to similarities of form. Thus two-year-old children demonstrate an early expectation that form similarity will be more valuable than color similarity for identifying the category members to which object labels refer. This expectation explains why form-based overextension errors are not unusual in children's early use of object labels, while color-based overextension errors are utterly lacking. Moreover, these findings imply that very young children possess a "Form - relevant / Color - irrelevant" expectation that matches the relative informativeness of these properties in the world of everyday object categories. This efficacious match helps explain the relative speed and ease with which children learn object labels and their underlying categories.

Children's emphasis on form similarity in their expectations about object label extensions also helps to explain their tendency to learn basic level labels prior to labels at either higher (superordinate) or lower (subordinate) levels of classification. The basic level of categorization is unique in capturing groups of objects that are maximally similar in form, while at the same time being maximally dissimilar in form from objects that are members of other categories. Therefore an expectation that form similarity will be important to object label extensions will lead children to sort objects into basic-level categories when trying to find the referents of new object labels.

Although children avoided extending novel labels solely on the basis of color similarity in the present study, it seems unlikely that children ignore color in their hypotheses about word-meanings in any absolute fashion. I say this for two reasons. First, many children have already learned a number of color labels (e.g., *red, green)* by the age at which they participated in this study. Learning color names clearly involves recognizing that color similarity can be relevant to word-meanings. Second, evidence from Gelman & Markman (1984) indicates that young children are in fact quite sensitive to the way color is used in language for making fine-grained contrasts within categories (e.g., *red apples* vs. *green apples).*

In closing, I would like to reiterate a fundamental point: the present study provides additional evidence that children possess special expectations about the meanings that new words are likely to have. It is true that these expectations sometimes lead children into error, such as when they overextend labels to objects similar in form. However, the errors caused by expectations such as the "Form - relevant / Color - irrelevant" one I have demonstrated are minimal when compared with the powerful advantages they confer.

References

Baldwin, D. A. (1985, April). *Exploring children's expectations about word-meanings.* Paper presented at the biennial meeting of the Society for Research in Child Development, Toronto, Ontario.

Brian, C. R., & Goodenough, F. L. (1929). The relative potency of color and form perception at various ages. *Journal of Experimental Psychology, 12,* 197-213.

Clark, E. V. (1973). What's in a word? On the child's acquisition of semantics in his first language. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language.* New York: Academic Press, 67-110.

Gelman, S. A., & Markman, E. M. (1985). Implicit contrast in adjectives vs. nouns: implications for word-learning in preschoolers. *Journal of Child Language, 12,* 125-143.

Gentner, D. (1978). What looks like a jiggy but acts like a zimbo? A study of early word meaning using artificial objects. *Papers and Reports on Child Language Development, 15,* 1-6.

Markman, E. M., & Hutchinson, J. E. (1984). Children's sensitivity to constraints on word meaning: Taxonomic vs. thematic relations. *Cognitive Psychology, 16,* 1-27.

Melkman, R., Koriat, A., & Pardo, K. (1976). Preference for color and form in preschoolers related to color and form differentiation. *Child Development, 47,* 1045-1050.

Melkman, R., Tversky, B., & Baratz, D. (1981). Developmental trends in the use of perceptual and conceptual attributes in grouping, clustering, and retrieval. *Journal of Experimental Child Psychology, 31,* 470-486.

Nelson, K. (1974). Concept, word and sentence: Interrelations in acquisition and development. *Psychological Review, 81,* 267-285.

Quine, W. V. O. (1969). Natural kinds. In W. V. O. Quine, *Ontological Relativity and Other Essays.* New York: Columbia University Press.

Rosch, E., Mervis, C. B., Gray, W., Johnson, D., & Boyes-Braem, P. (1976). Basic objects in natural categories. *Cognitive Psychology, 8,* 382-439.

Suchman, R. G., & Trabasso, T. (1966). Color and form preference in young children. *Journal of Experimental Child Psychology, 97,* 439-451.

Tomikawa, S. A., & Dodd, D. H. (1980). Early word meanings: Perceptually or functionally based? *Child Development, 51,* 1103-1109.

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SITUATIONAL PROPERTIES OF EARLY VERB MEANING

Pol Cuvelier
UFSIA University of Antwerp, Belgium *

Nowadays developmental research hardly shows any doubt as to the role of the interaction context in language acquisition. The first stage of lexical acquisition is believed to include a huge amount of situational information.
The assumption that word meaning is referential from the outset is no longer held. However, for a long time the acquisition of word meaning was believed to be simply a question of establishing a link between a linguistic symbol and the right referent in the outside world.

For the stages beyond the very beginning, the referential meaning assumption is still very common. It is predominant in most versions of the Semantic Feature Hypothesis and also in alternative theories such as Bowerman's (1985) prototype-approach or Barrett's (1982) contrastive hypothesis. Referential approaches imply a straightforward relation between language mastery and knowledge of the world.
The present paper questions the validity of the referential approach for verbs in the period between 2 and 3. An alternative is proposed in which, besides referential properties, context properties are also integrated into verb meaning. At the same time, the approach implies a strong cognitive intervention by the child.

The situational context is, of course, a very obvious basis for early verb meaning. Verbs, unlike object nouns, relate to a wide range of phenomena in the outside world. They refer to processes that develop through time (e.g. grow, deteriorate, ...), the referent actions or events have no sharp boundaries (travel, wander, float,...) and they very often involve a great many people or objects. In addition, the objects and the people involved behave in very specific ways and the distinctions are highly functional (cp. the role of the agent in lay vs. lie, the importance of the reference point in go vs. come, or the intentionality of the moving object in follow vs. drag behind, etc.). So, even from an adult point of view, verbs incorporate meaning properties other than reference in its strict sense.

Apart from that, there is also ontogenetic evidence that leads one to expect properties of the communicative context in verb meaning, even at a stage when the child is already able to refer to real-word objects by means of object words.

As a matter of fact, the social context appears to be crucial for the language learner (Uzgiris 1981): the interaction of a child with the outside world is relevant for language acquisition only to the extent that it is SOCIAL interaction, i.e. interaction with people. This is reflected in the fact that early words are acquired in formats (e.g. Bruner 1983) or interaction routines (e.g. Moerk 1985), that they are linked to the child's plans (Gopnik 1982, Gopnik & Meltzoff 1985) and

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* Author's address: UFSIA, Rodestraat 12-14, B-2000 Antwerp, Belgium

presented in illocutionary contexts (e.g. Ninio 1985). Early words are known to express primitive language functions or speech acts (Halliday 1975, Greenfield & Smith 1976, or Bates 1979 for a survey).
Even for the stages after the very beginning, there is explicit--though occasional--reference to the overwhelming role of the communicative context (in the use of verbs):

> Were they (= the utterances with door, P.C.) constative for the children? We think not. The evidence on which to base an argument cannot be syntactic because almost all of the 'door-utterances we recorded were holophrastic. One might approach the question through pragmatics. Note that stative uses of predicates like open e.g. the door is open, are necessarily constative, i.e. descriptive. Now, without exception, all the earliest uses of door in our data were requests. Requests are not constative. Therefore all we can conclude from this line of argument is that the first doors were not stative and, hence, might have been causative.
>
> (Griffiths & Atkinson 1978: 314)

To sum up, adult verb meanings incorporate a wide range of situational information (as opposed to object noun meanings, which refer to particular objects). In addition to that there is also ontogenetic evidence to look for the roots of verb meaning in the communicative context in which verbs are used.

Within the interactional framework the properties that are most likely to play a role in early word use belong to speech act contexts for speech act contexts have high communicative relevance.
Of course there is a fundamental difference between illocution and the situations that go with speech acts. Illocution involves the attitude the speaker wants to communicate to the listener. However, as speech acts can only be performed adequately in particular contexts, these contexts are essential.

Our hypothesis thus amounts to the claim that verbs consistently occur in particular illocutionary contexts, that each verb has its own context and that verbs differ from one another in that respect. The illocutionary context should thus be included in early verb meaning.

METHOD

We have looked for empirical support in production data from one Dutch-speaking child, Jeroen (diminutive Jeroentje), the researcher's oldest son. Jeroen was observed between 2;0.8 and 2;11.26 (MLU 1.31-3.06). Recordings were made at monthly intervals. A case study was performed, in spite of its obvious drawbacks, because it allows a thorough analysis.
As we did not want to bias the interaction variables that were the subject of our investigation we relied on naturalistic observation only. We used unobtrusive and flexible equipment for the audio-recordings (24 hours in all) at the child's home. The interaction context was recorded by means of an 8 mm movie camera with an interval timer. The pictures were meant to provide additional information. All

interaction was transcribed immediately after the recordings.

In the analysis itself we concentrated on the utterances related to motion and location. The choice of motion and location is motivated by the fact that they are relatively well-defined and easily identifiable. Consequently, we might expect reference to emerge here first and to override the influence of the communicative situation.
The context properties scored were directly derived from the felicity conditions that are associated with speech acts in the traditional framework (Searle):

e.g. REQUEST
prep. cond.: H is able to perform A
S wants H to perform A
in terms of communicative context this leads to:
event is ACTION (to be performed by someone, viz. H)
event can be performed by H (H is the agent)
event can be ordered by S

The main reason to adopt Searle's framework is the strong connection between speech acts, felicity conditions and situational context. Felicity conditions define the communicative situation that is required for a speech act to be appropriate. They form the presupposition for the speech act. There is no fundamental difference between that sort of presupposition and the presupposed meaning properties of verbs in it. Moreover, by age 2 - the start of the recordings - the major speech act categories (representatives and directives) are well established.

step 1: speech act scoring
step 2: scoring of corresponding context properties
(15 % of the utterances were also scored by a second judge (the child's mother). Inter-judge agreement was 89 %)
step 3: sorting procedure (per recording and per verb)
step 4: quantitative analysis
1. presence of clusters of properties that occur in over 50 % of the utterances
2. presence of clusters of properties that occur in less than 50 % of the utterances
step 5: qualitative interpretation of the clusters

Fig. 1. Summary of the procedure of analysis

We proceeded as shown in Fig.1. First of all features were identified that occurred with every occurrence of a verb. However, as the frequency of occurrence varied greatly, the features were ranked and the presence of feature clusters was checked for.

R E S U L T S

General

No criterial features of a communicative or situational nature were

found: verbs have, apparently, no properties related to the communicative context that occur all the time and that distinguish one verb from the other.

However, although criterial features are missing, every verb has a number of context features that are frequent and that tend to appear together. They fit in with the predictions of a so-called prototypical framework. Prototypical features belong to prototypical exemplars of the (verb) category (Rosch 1978). They are frequent, they tend to occur in clusters and they are related to the cognitive or experiential background of the language user.

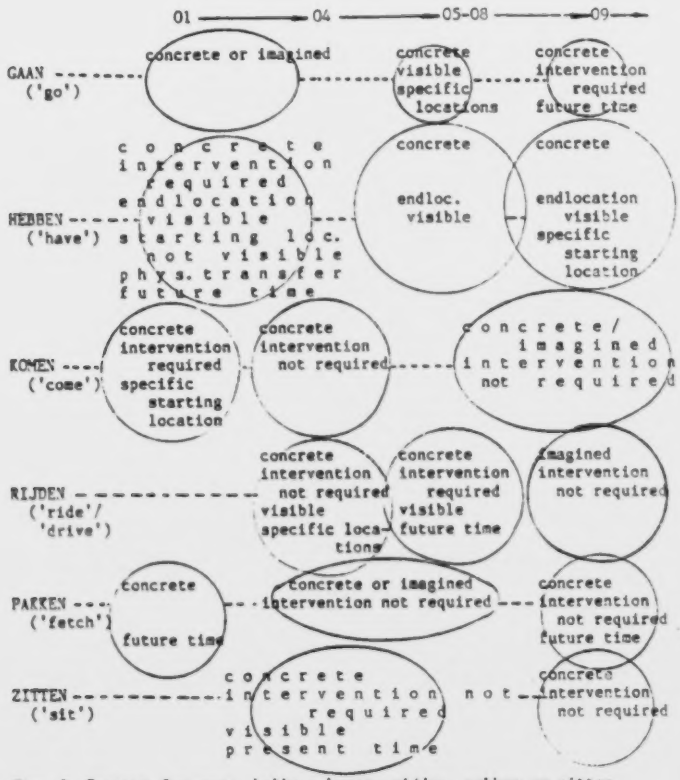

Fig. 2. Pattern for gaan, hebben, komen, rijden, pakken en zitten

Details

Figure 2 is a schematic summary of the pattern that emerges for six common verbs.
In this section the pattern for the verbs gaan 'go', hebben 'have', komen 'come' and rijden 'ride/drive' is illustrated by means of some of the actual utterances. The properties mentioned are prototypical, hence they do not necessarily occur in each and every instance of the verb.

The prototypical illocutionary context associated with gaan can be summarized as follows:

> Gaan requires a situation that the speaker experiences as a direct transition. The transition need not be visible or concrete as long as it is psychologically salient.

In that respect gaan differs from komen or from hebben which require somebody's intervention, and--at the beginning--from zitten 'sit' which requires the situation to be visible. Some examples:

(1) Father: waar is de beer ? 'where is the bear ?'
J: rrr - eg aan (I, 688) 'rrr - gone away'
(he means 'gone' but that is absolutely not true; speech act: reaction to a question-word question - assertion about an imagined event in the past)

(2) gaan ne niejejiepe (V, 303) 'does not no no go'
(J does not manage to drive any further on his little bike; "niejejiepe" is a playful extension of niet 'not'; speech act: deixis-assertion (*)

(3) smurf gaat mee kijk (VIII, 571) 'smurf goes along, look'
(J is playing: he makes puppets do different things; speech act: assertion about event that is mostly imagined - deixis-assertion)

(4) gaat om benzine (VIII, 447) 'going for gas'
(J repeats his description: the toy puppet is going to the toy gas station to get gas; speech act: assertion about a play situation - deixis-assertion repeated)

Hebben 'have' stands out very clearly in illocutionary situational terms. At first (up to recording 05) it is necessarily associated with an action context involving somebody's intervention. That is quite surprising, considering the adult 'meaning' of the verb:

(5) fiets en 'bike have' (I, 887)
(J repeats that he wants to have his toy bike; speech act: repeated request for an object that is absent)

(6) dien hebben (III, 69) 'this one have'
(J wants his brother Bram to hand him in his strainer a particular container filled with sand; speech act: repeated request for an object that is present)

It is only later that more flexibility appears: from recording 08 on hebben is also used in cases in which the intervention of the listener is not required.

The deictic characteristics of komen do not show in the use of demonstrative words, but the verb has a very specific illocutionary context. Initially, komen is used in contexts that include somebody's intervention and (for the speaker) the event is known to start from a particular location. Examples:

(7) kom niet (I, 465) 'not come'
(J does not want his niece Trui to come for a visit; speech act: reaction to a question-word question - repetition of (negative) request)

---

* assertion about a visible event

(8) komn mama (II, 346) 'come mama'
(J wants to get to his mother; speech act: auto-directive, intention)

Later on the person who performs the action may vary. At the beginning, komen does not even require a concrete event-context. It only does from recording 08 on:

(9) kijk, kom zelf mee (VIII, 140) 'look, comes itself with'
(J says that toy horse itself comes along with the toy car; speech act: assertion about imagined event / deixis-assertion)

(10) kijk - kom poes - daar (VIII, 211) 'look comes pussy - there'
(J announces the arrival of a cat in the play context; speech act: repetition of an assertion about an imagined event / deixis-assertion)

At the outset rijden is used only when a relation is involved that is visible and concrete, as in

(11) 'roentje weg rijden (IV, 303) '(Je)roentje is riding/driving off'
(J is playing and, at the same time, describing his action; speech act: deixis-assertion)

In later recordings the intervention context shows up as well and concreteness is no longer required. Probably the 'rijden'-event is so well defined referentially that it can be imagined:

(12) kan wel rijden (VIII, 197) 'can drive'
(J maintains that a particular puppet will be able to ride/drive, contrary to mother's assertion; speech act: rejection of assertion about imagined event - assertion about imagined event)

(13) roentje zegt tegen auto boem en dan rijdt hij weg (IX,164) '(Je)roentje says to car 'boom' and then it drives away'
(J continues his story of some imagined event; speech act: assertion about an imagined event)

D I S C U S S I O N

The results of this case study show that a level of illocutionary-situational verb meaning has to be taken into account.

The data also tends to support the idea that the symbolic use of verbs is quite different from the symbolic use of object words. Our subject is at an age at which he is quite able to refer to objects. But as soon as actions or events--even if they have a firm referential basis--are concerned, he appears to bring in the entire context again.

One explanation could be the complexity of verbs, as opposed to object nouns (cp. Gentner 1982). Several researchers (Bowerman 1985, Wolf & Gardner 1981, Van Geert 1985) have pointed to the difference between representation and symbolizing, or even between perception, representation and language.

Nouns differ from verbs both on the representation level and on the symbolizing level. Representing an object is easier, as it merely calls

on the child's faculty to abstract on the basis of (perceptual) saliency. Representing actions or events is more difficult, as the choice of what to abstract is harder: often an event involves several objects or motions, and there is no obvious salient property within an event. Symbolizing in language differs, too. Objects are salient by themselves. So the child can easily pick an object, which is a stable item, from a situation and attach a noun to it. Event representations leave room for more diversity.

Our findings, however, do allow symbolic mastery as a major factor. The child does make abstractions, not on the representational, but on the pragmatic level. Situational binding continues to be present, but it becomes more conventionalized. We would suggest the following stages:

The verb is associated with a situation that the child has experienced or that is salient (strikes the eye, ...)

↓

The verb is associated with a prototypical situation type (script)

↓

Abstraction on the linguistic level: the verb is associated with particular referential and illocutionary properties of the situation

↓

Further abstraction:
verb meaning is made up of referential properties, including some that have illocutionary roots (e.g. dynamism)

The stage observed here is the one before the last: the child does not bring in the entire prototypical situation but he does bring in some (rather abstract) features that are most significant, probably because they are very functional.

The advantage of this explanation is its systematic character. The context properties we use derive directly from speech act contexts. In that way a smooth transition is possible all the way from very early word use (which is fully "pragmatic") to the use of adults, for whom speech acts and speech act contexts are still very relevant.

CONCLUSIONS

Provided these findings are supported by data from other children, they lead to the conclusion that early verb meaning is not just biased by non-linguistic, situational factors. It is, for some time at least, made up of situational and interactional properties that differ on a verb per verb basis.

Moreover, contrary to the expectations of Snyder, Bates & Bretherton 1981: 577), the type of pragmatic binding CAN be filled in. The original experiential context has many significant traits, each of which could be picked out by the child. But the child does not choose at random. He sticks to the traits that are most functional: those that belong to the illocutionary situation.

As far as cognition is concerned, the level of abstraction that the child is able to reach for object words is not absent from his verb

use. But the abstractions are in the pragmatic, not in the referential domain.

REFERENCES

Barrett, M.D. (1982) "Distinguishing between prototypes: The early acquisition of the meaning of object names." in St.A. Kuczaj II (ed.), Language development. Vol. I., Hillsdale, N.J.: Erlbaum.

Bates, E. (1979) The emergence of symbols: Cognition and communication in infancy, New York: Academic Press.

Bowerman, M. (1985) "Beyond communicative adequacy: From piecemeal knowledge to an integrated system in the child's acquisition of language." in K.E. Nelson (ed.), Children's language. Vol.5, Hillsdale, N.J.: Erlbaum.

Bruner, J. (1983) "The acquisition of pragmatic commitments." in R.M. Golinkoff (ed.), The transition from pre-linguistic to linguistic communication, Hillsdale, N.J.: Erlbaum.

Geert, P. van (1985) "In, op en onder: over de aard van ontwikkelingsvolgorde in taal." Interdisciplinair Tijdschrift voor Taal- en Tekstwetenschap 5,3: 203-218.

Gentner, D. (1982) "Why nouns are learned before verbs: Linguistic relativity versus natural partitioning." in St.A. Kuczaj II (ed.), Language development. Vol. II., Hillsdale, N.J.: Erlbaum.

Gopnik, A. (1982) "Words and plans: early language and the development of intelligent action." Journal of Child Language 9: 617-633.

Gopnik, A. and A.N. Meltzoff (1985) "From people, to plans, to objects. Changes in the meaning of early words and their relation to cognitive development." Journal of Pragmatics 9: 495-512.

Greenfield, P.M. and J.H. Smith (1976) The structure of communication in early language development, New York: Academic Press.

Griffiths, P. and M. Atkinson (1978) "A 'door' to verbs" in N. Waterson & C. Snow (eds), The development of communication, Chichester: Wiley.

Halliday, M.A.K. (1975) Learning how to mean, London: Edward Arnold.

Moerk, E.L. (1985) "Picture-book reading by mothers and young children and its impact upon language development." Journal of Pragmatics 9: 547-566.

Ninio, A. (1985) "The meaning of children's first words. Evidence from the input." Journal of Pragmatics 9: 527-546.

Rosch, E. (1978) "Principles of categorization" in E. Rosch and B.B. Lloyd (eds.), Cognition and categorization, Hillsdale, N.J.: Erlbaum.

Snyder, L.S., Bates, E. and I. Bretherton (1981) "Content and context in early lexical development." Journal of Child Language 8: 565-582.

Uzgiris, I.C. (1981) "Experience in the social context. Imitation and play" in R.L. Schiefelbusch and D. Bricker (eds.), Early language: Acquisition and Intervention, Baltimore: University Park Press.

Wolf, D. and H. Gardner (1981) "On the structure of early symbolization" in R.L. Schiefelbusch and L.L. Lloyd (eds.), Language perspectives. Acquisition, retardation and intervention, Baltimore: University Park Press.

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SIMILARITY, SPECIFICITY AND CONTRAST: A STUDY OF EARLY SEMANTIC CATEGORIES*

Esther Dromi
Tel-Aviv University

and

Gil-li Fishelzon
University of Haifa

From various sources, including anecdotal descriptions by parents, calculations of the different words in periodical audio-recordings, and detailed case-studies of early lexical development, a number of quantitative characteristics of the one-word stage emerge. Children start to utter early words around their first birthday and subsequently they produce "one-word at a time" for an extended period of 8 to 12 months. Complete lexicons of single words contain between 250 to 350 different entries of adult input language, and the rate at which these words are learned is not steady throughout the stage. Initially new words are added slowly, and during the second half of the stage an abrupt change in the rate of vocabulary growth is noted (e.g. Anisfeld, 1984; Bloom, 1973; Corrigan, 1976; Dromi, in press; McShane, 1980).

Since early lexical acquisition is so extended in time, yielding impressively large vocabularies, it becomes necessary to examine the contents and the underlying semantic structure of such vocabularies. This examination may reveal which contents are picked up by the young child to be lexicalized, to what extent early vocabularies are compareable, and whether young children at the one-word stage do treat related words as belonging to the same semantic categories. The study of lexical diversity is not simple since it involves a longitudinal evaluation of a complex developmental process which entails constant reorganization. Very often a newly acquired word is linked to already existing words in the child's lexicon, which themselves may then undergo semantic redefinition as a result.

In the present study we examined the semantic underlying structure of four complete one-word stage lexicons of Hebrew speaking subjects. We focused

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on the description of how early words are learned in terms of both the timing of their acquisition, and the patterns of identified relationships among them. We tested whether lexical acquisition is characterized by the addition of classses of semantically related words, or by the accumulation of unrelated words which only later become organized as semantic classes. The following three types of interrelationships among early words were tested:

a) Relations between equivalent members of the same category (e.g., a teaspoon, a cup and a knife);
b) Relations of contrast and synonymity (e.g., come - go, nice - kind); and
c) Relations of superordinate-subordinate terms (e.g., food - soup, rice, meat).

The data and analyses

Our data-base consisted of four diary records in which mothers documented the lexical development of their own children.[1] The four records included information about new words as well as descriptions of repeated applications of old words in various non-linguistic contexts. The subjects were from upper-middle class families of native Hebrew speakers, three girls and one boy. The girls were first-born children and the boy a seond child. In comparison the three girls, M, K, and Y, started to talk quite early at the ages of 8(16),[2] 10(12) and 10(16), respectively. The boy G uttered his first words relatively late, when he was 16(0). His record was the smallest and it included only 106 different Hebrew words.[3]

Table 1: The four lexicons of Hebrew speaking one-word stage subjects

Subject	Size of lexicon	N. of analysed words*
M	270	264
K	337	298
Y	338	320
G	106	102

*Personal names were excluded from the present analysis.

1 Two diarists were the authors of this paper, the other two mothers were trained by the first author. We thank the mothers of Y and G for collecting the data.
2 8(16) is to be read 8 month and 16 days.
3 G's record is included in the present study despite its non-typical characteristics. As will be shown, the record was quite detailed and therefore analysis could be performed on it. In the present paper we will not refer to the unique characteristics of this record, and neither will we try to explain it.

In examining the lexicons we made a clear distinction between two levels of analysis. At the first level we examined the complete lexicon of each child during the last week of study and grouped the words into semantic classes that corresponded to semantic fields of adult language. This kind of analysis took into consideration each word only once and was based on the adult's frame of reference. We termed this procedure: the end-state analysis. The second level of analysis was developmental. Here we followed the course of generation of each semantic class and also evaluated changes over time that were noted in the underlying structure of each category. Words were classified as semantically related, at this level of analysis, only if we could identify evidence of relationships in their actual applications in repeated uses. The following set of indicative criteria were used in order to indentify relationships among early words: overextension; misuses of labels and interchangeable labeling; acquisition of superordinate terms; proximity in the time of learning semantically related terms; and concomitant expression of two terms when it was clear that one word is uttered to anchor the meaning of the other (e.g. giddiup-horse, food-bread).[4]

Results

The end-state analysis revealed that the vocabularies of our one-word stage subjects consisted of over 20 different categories of semantically related terms. This figure is significantly larger than we had anticipated on the basis of earlier reports (e.g. Nelson, 1973; Rescorla, 1981). Even G, whose lexicon was far more restricted than the others, acquired 22 different classes of words during the one-word stage. Table 2 shows that the four subjects acquired words of very similar semantic contents. The between-subject variability was very small. All the children acquired at least some representatives of the overwhelming majority of categories during the first half of the one word stage. M acquired 92% of her categories during the first half of the stage, Y and G exhibited a similar pattern and acquired 88% and 95% of their categories that early, and in the case of K, 73% of her categories were represented during the first half of the stage which lasted 16 weeks.

Both synonyms and antonyms were identified in the end-state analysis. The number of antonyms (i.e. M=29, K=17, Y=14, and G=10) greatly exceeded the number of synonyms (i.e. M=8, K=5, Y=3, and G=2). Most antonymic pairs

4 Explicit operative definitions of the above criteria appear in Fishelzon 1985.

TABLE 2 - The categories of the end-state analysis and the timing of their emergence *

Categories	Subjects			
	M	K	Y	G
Animals	F	F	F	F
Body Parts	F	F	F	F
Clothes & Personal Accessories	F	F	F	F
Kinship Terms	F	F	F	F
Food & Drinks	F	F	F	F
Toys	F	F	F	F
Vehicles	F	F	F	F
Kitchen Utensils	F	S	F	S
Furniture & Household Accessories	F	S	F	F
Bowel Movement	-	F	F	F
Qualities	F	F	F	F
Sounds	F	S	F	F
Motion & Movement	F	F	F	F
Kinds of Illness	F	F	F	F
Interpersonal & Social Terms	F	F	F	F
Questions	S	F	S	F
Location & Direction	F	F	F	F
Positions of Body	F	S	F	F
Quantities	F	F	F	F
Actions & Manipulation of Objects	F	F	F	F
Weather	S	S	S	-
Vegetation	F	S	F	F
Self & Others (pronouns)**	S	S	S	F
Shapes	F	F	-	-
States & Sensations	F	S	-	-
Temporal Terms	F	S	S	-
Total N of Categories	25	26	24	22

* Each category consists of at least three different lexical items. The recording of the first word in each category is taken as evidence of its emergence. Timing was calculated separately for each subject; F = the first half of the one word stage, S = the second half of the one word stage.
** Personal names were excluded from this analysis.

encoded graded relations (e.g., cold - hot), and only a few were of the converse kind (e.g., give - take). Converse pairs were problematic for all children who displayed confusion in their early applications. Thus, all subjects said 'take' when they intended 'give me', and two subjects (K and Y) initially said 'come, come to me' when they wished to be picked up by an adult, or when they wanted to go outside. Extremely few superordinate terms were identified in the four lexicons.

Only Y and M acquired the general terms for toys and clothes. All subjects acquired the term 'food', but used it as a superordinate term only towards the very end of the one-word stage. All uses of the superordinate terms were correct or adult-like in the very first records.

The developmental analysis yielded a lower number of categories compared to the ones identified before. Clear evidence of acknowledged relationships among words were noted for only 17 different categories in M's and K's lexicons. Y had 14 different recognized categories, and G's record contains clear evidence that he recognized relationships among different words in only seven categories. The developmental analysis confirmed our previous finding that categories are formed early during the one-word stage. All of the subjects had acquired few representatives of almost all classes by the end of the first phase of the stage. Moreover, while during the first half of the stage the addition of related words to an existing category was slow (and sometimes several weeks passed before the child acquired a semantically related term) during the second phase categories were filled-in very quickly.During this later phase the children often learned closely related words during a single week. An illustrative example is K's acquisition of the terms 'undershirt' 'to put on, or dress', 'underpants', 'pants, trousers', 'pantyhose' and 'socks' within three days in the 26th week of study (see more on that in Dromi, in press: Chapters 10, and 12).

There were cases in which we could not identify any sign of recognition of relationships among words that in fact belong to the same adult semantic field. Kinship terms were learned slowly by Y, but she never overextended existing terms to denote related meanings for which she had not yet acquired labels. M's class of kitchen utensils was elaborate. It included the terms 'a bottle', 'a plate', 'a spoon', 'a glass', 'a goblet', and 'a fork'. M never confused these terms and it was clear that she differentiated between the referents and correctly mapped them onto conventional words.

In the attempt to identify underlying processes in the formation of semantic categories we could not isolate a single process which was operative for all the children or even across a single lexicon. A comparison of the four lexicons, however, revealed the following identical strategies which are illustrated below:

a) Selective extension of a term: A single term denotes more than a single referent, but the scope of extension is limited to only a subset of adult category.

K: pipi 'urine'; Used for the top part of a nakeed body, the stomach, breast, and belly button and never used for a hand, a leg or parts of the face.

M: dag 'fish'; Used for turtle and fish and never extended to other animals.

b) Original groupings: The child extends a term beyond the limits of a given semantic field or a given grammatical class.

G: tas 'to fly'; Used for airplanes, birds, the moon and the action of flying.

M: xam 'hot'; Extended to hot foods and drinks, to the tap and water in the bath, to different clothes, and also to the action of undressing and taking off a necklace which was too tight.

c) Subdivision of a class: The child encodes verbally contrasts which are not lexicalized in adult language.

M: kos 'a glass'; Used for drinking glasses, mugs, and bottles.

totn 'to drink'; Used for her own drinking glass, her bottle, and the action of drinking.

K: lala; A request to hear music on the radio, or to watch a TV show. Also said while playing with the buttons of a washing machine.

šir 'a song'; A request that mother sing a song.

Y: ha 'hot'; Used for liquid foods which are eaten from a soup plate.

bis 'a bite'; Used for food items which the child could bite e.g. bread, wafers, snacks.

d) Evidence of reorganization within a semantic class: The addition of a new word to an existing category causes confusion and "late errors" emerge.

M: ein 'no more'; Used in correct contexts until the word yes 'there is' was acquired. When having both terms the child misused them both, and uttered ein to refer to existence and non-existence as well.

K: tets 'to go out'; Used correctly until its antonym ikanes 'to go in' was acquired. Thereafter ikanes was overextended and used for going in and out as well.

e) Contextual categories: There is evidence of grouping together different objects and actions which can be recognized as constituents of the same situation.

K: hita 'going out'; Used for her own hat, her bottles, mother's purse, plastic bags, her stroller, and said while walking around the house and holding a purse.

Y: gan 'kindergarten'; Used for a playground, children playing outside, a swing, a slide, a kindergarten building, and children in general.

f) A new word as a synonym: A new word is uttered together with an old word which encode similar meaning.

K: dod 'an uncle'; Initially used for both strangers and noises coming from outside, later when bum was acquired for noises the child said dod-bum when she referred to noises.

M: oid 'to take off'; Initially used for taking off and taking out. When totsi 'to take out' was acquired the child said oid-totsi when she referred to taking out.

The similarity observed for all subjects is significant since it indicates that the processes noted above are general and can not be considered idiosyncratic for single subjects. The fact that we could point to such a high similarity among the four diaries proves that subjective detailed descriptions of mothers do not exclude the possibility of carrying out more objective analyses which are also comparative.

Conclusions

The results of both analyses support Dromi's (1986, and in press) ealier claim that the one-word stage is, in fact, divided into two developmental phases. The present study suggests that during the initial phase it is mainly unrelated words that are learned by the child. The lexical acquisition is characterized by a horizontal covering as many categories as possible, each containing only few members. In the second phase an abrupt change in the rate of learning new words is documented (Bloom 1973; Corrigan, 1978; Dromi, in press). This phase is characterized by a vertical differentiation within existing categories that were created during the first phase. The child's linguistic development during the second phase is much faster and more efficient. During the second phase the child lexicalizes much finer distinctions than he did before.

Our findings support Clark's (1983, 1985) recent proposal that very young speakers appreciate the principle of lexical contrast. As we have shown, children proceed from lexicalizing wide contrasts to lexicalizing finer ones. In some cases, children even innovate words for expressing contrasts which are not conventionally encoded in the adult input language. Not all child categories are equivalent to those of adults. Non-conventional groupings are detected in one-word stage vocabularies. We found that in some cases early meanings are related only because words which encode them are learned under similar external conditions of situation, input, and perceptual contiguity. This finding supports recent claims that the initial meaning representations of some words are holistic rather than componential (Barrett, in press; Dromi 1984, in press; Nelson & Lucariello, 1985).

Our findings indicate that several early words encode repeated situations which reoccur regularly, and that not all experiences are encoded or conceptualized in the same manner by the learner. In the course of building up a productive lexicon several processes of category formation are followed simultaneously by the young child.

References

Anisfeld, M. (1984). Language development from birth to three. Hilsdale, New Jersey: Lawrence Erlbaum.

Barrett, M.D. (in press). Early semantic representation and early word usage. In S. Kuczaj & M.D. Barrett (eds.), The development of word meaning. New York: Springer.

Bloom, L. (1973). One word at a time. The Hague; Mouton.

Clark, E.V. (1983). Meaning and Concepts. In P.H. Mussen (ed.). Handbook of child psychology. Vol. III Cognitive development. New York: John Wiley & Sons.

Clark, E.V. (1985). The Principle of Contrast: A Constraint on Language Acquisition. In M.D.S. Braine and B. MacWhinney, (Eds.), Proceedings of the 20th Annual Carnegie Symposium on Cognition: Mechanisms of Language Acquisition.

Corrigan, R.L. (1976). Pattern of Individual Communication and Cognitive Development. Ph.D. Dissertation, University of Denver.

Dromi, E. (1984). The word-context production strategy in the early acquisition of meaning. In C.L. Thew & C.E. Johnson (Eds.), The Proceedings of the Second International Congress for the Study of Child Language. Vol. II. New York: University Press of America.

Dromi, E. (1986). The one-word period as a stage in language development: Quantitative and qualitative accounts. In I. Levin (Ed.), Stage and structure: Reopening the debate. Norwood, New-Jersey: Ablex Publishing Corporation.

Dromi, E. (in press). Early Lexical Development. Cambridge, England: Cambridge University Press.

Fishelzon, G. (1985). Lexical diversity and the development of relationships between words in the early lexicons of the one-word stage. M.A. Thesis. Univesity of Haifa, Israel.

McShane, J. (1980). Learning to talk. Cambridge, England: Cambridge University Press.

Nelson, K. (1973). Structure and strategy in learning to talk. Monograph of the Society for Research in Child Development, 38, (1-2 serial no. 149).

Nelson, K. and Lucariello, J. (1985). The development of meaning in first words. In M.D. Barrett (ed.), Children's single-word speech. New-York: John Wiley & Sons.

Rescorla, L.A. (1981). Category development in early language. Journal of Child Language, 8, 225-238.

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The Role of Correction in Language Acquisition [1]

Cheryl R. Garcia and Jeri J. Jaeger
University of California, Davis

1.0. Introduction

1.1. Negative Evidence. One of the most fundamental issues in learnability theory has been the characterization of input to the language learner as a component in the language acquisition model. The Gold model (1967) represents one of the earliest attempts to describe the nature of input, delineating two such levels. The first, designated 'text-presentation', comprises the presentation of well-formed sentences in the langauge, and as such, constitutes positive evidence. The second, labeled 'informant-presentation', consists of a sample string together with information on whether the utterance is a positive or a negative instance of the target language, that is, whether the utterance is plus or minus grammatical. This promising line of approach was temporarily quelled with the publication of Brown & Hanlon 1970 (hereafter B&H). In this study, B&H found that parental approval and disapproval of children's utterances was not contingent on syntactic correctness. The authors claimed that this indicated unequivocally that children are not exposed to 'informant-presentation' type input. For over a decade, the B&H conclusion remained relatively unchallenged, and served, moreover, as a basis for subsequent theorizing on the issue of learnability. In particular, it was taken by proponents of 'innateness' hypotheses as evidence for the relative insignificance of adult input to the language acquisition process.

Recently, however, B&H's position has come under scrutiny, most notably by Hirsh-Pasek, Treiman, & Schneiderman (1984). Among other things, these authors criticize B&H's narrow definition of negative evidence as overt correction. Hirsh-Pasek et al. increase the scope of the definition to include repetition with correction, otherwise known as 'expansion'. Incorporating this as well as other modifications to the experimental design, they replicated B&H's study and found that although caretakers did not provide <u>explicit</u> negative evidence in response to ill-formed utterances (i.e. overt correction), they were more likely to <u>repeat</u> ill-formed than well-formed utterances. Furthermore, 'virtually ALL repetitions of the ill-formed sentences included a correction of the child's error' (86). They conclude that parental repetition of the child's utterances 'could help the child to narrow down his hypotheses about candidate grammars as he begins the job of inducing the grammar of his native language... It is therefore worth studying whether the child attends to and benefits from this cue' (87).

The question of whether children can accept and utilize negative evidence when adults do offer it has also tended to receive a negative answer in the literature. Anecdotes such as the infamous 'Nobody don't like me' exchange (McNeill 1966) have been used to argue that children largely ignore corrections. However, it is often overlooked that the child in this exchange <u>did</u> modify his sentence to 'Nobody don't <u>likes</u> me' (after being corrected eight times), and McNeill notes that '[t]he fact that a change ultimately was made...illustrates that children can profit from adult models' (69). Similarly, McCawley

(1979:243) points out that '...all that [this anecdote] shows is that at that point in his development the child could not accurately perceive that particular correction. It says nothing about whether the same correction would have been effective at another time or other corrections would have been effective at that time.' It is clear that the issue of children's utilization of negative evidence remains open.

The current study, then, was designed to further explore the question of whether or not children can make use of negative evidence, particularly corrected repetitions of their own incorrect utterances. Further, it explores the hypothesis presented by Clark (1982:189) (and also suggested by McCawley above) that 'what gets repaired at different ages appears to be linked to what the child has already mastered and what he's on the verge of mastering.'

1.2. The Present Study. In order to test the questions raised above, a pilot study was conducted in which subjects were asked to repeat sentences after the experimenter, and were corrected if they made a structural mistake in the repetition; they were then asked to repeat the utterance again, and their responses were noted. The sentences the children were asked to repeat were designed to reflect grammatical structures from the developmental progression suggested in various papers in Fletcher and Garman (1979). The categories represented in the corpus included modals, questions, conjunctions, verb aspect constructions, embedded constructions, causatives, and passives. Table 1 depicts graphically some predictions that have been made regarding the order of acquisition of these structures, and indicates sources for these predictions. Within grammatical categories, specific structures predicted to occur early are located at the left side of the figure, and later developments are shown at the right; further, the vertical alignment of categories is designed to give some notion (albeit imprecise) of the relative lateness of acquisition of the different grammatical categories compared to each other.

The two questions asked by this experiment are: 1) If children repeat an adult utterance incorrectly and then hear it corrected, will they utilize this information to correct their incorrect utterance a significant proportion of the time, or will they ignore the adult correction? 2) Is there some developmental progression involved; that is, do children make fewer initial errors and, more importantly, utilize corrections more readily for structures predicted to be learned earlier? Answers to these questions will provide significant data on the issues of learnability raised above.

2.0. The Experiment.

2.1. Experimental Design.

2.1.1. Subjects and Materials. Subjects were four girls and four boys aged 2;7 to 3;8 (mean 3;2). All attended the same pre-school, which selectes its students so as to maintain a heterogeneous sample in terms of age and sex, as well as ethnic and socio-economic background. All Ss were acquiring American English as a first language.

The experimental materials consisted of five pictures of cartoon characters and of seven statements or questions about each. The first picture depicted the characters Sylvester and Tweety picking corn, the second a clown and a pig riding a bicycle, the third children and their pets, the fourth various holiday scenes, and the fifth Tweety and Sylvester fishing. The list of 35 sentences included exemplars of

Table 1:
Types of grammatical cagetories and structures used in experiment, with indication of predicted developmental progression of acquisition.

MODALS (Fletcher 1979)

early	late
present tense	past tense

QUESTIONS (Garman 1979)

early	late
WH-questions	yes/no questions

CONJUNCTIONS (Bowerman 1979)

early	late
and/and then/but/or	either...or/both...and/before/after

VERB ASPECTS (Fletcher 1979)

early	late
progressive	perfect

EMBEDDING (Bowerman 1979)

early	late
on object position	on subject position

CAUSATIVES (Karmiloff-Smith 1979)

early	late
	causatives

PASSIVES (Karmiloff-Smith 1979)

early	late
irreversible	reversible

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all of the various structures represented in Table 1. The sentences ranged from 3-6 words in length, with a mean length of 4.4 Ordering of the various structures was randomized over the 35 strings. To preserve this random order of presentation, the ordering of the sentences within each set of seven was held constant.

2.1.2. **Procedure.** The study took place on school grounds in a small building used specifically for on-site research. Ss were interviewed individually, and tape recordings were made of all sessions. Each interview consisted of E's explaining to the child that they were going to look at some pictures together and play a game. In the game, E would say a sentences about the picture, and the child was to try to repeat it exactly the way E said it. Ss were allowed to choose the

order of the pictures, in order to sustain their interest and encourage cooperation. [2]

If Ss made a structural mistake in repeating an utterance, they were corrected by E. Correction was of two types: the first was overt correction with expansion, for example, 'That's almost right. Can you try it again?' and E would then repeat the correct utterance. The second type was expansion alone, without any overt statement about the correctness of the child's original utterance. Overt correction was used only 20% of the time; the remainder of E's prompts were expansions only. As a control, E would occasionally ask a child to repeat a correct utterance; these prompts consisted of repetition only.

2.2. Results. Tapes of the interviews were transcribed, and Ss' responses were scored according to the following system. A response was scored as I, meaning 'initially correct', if the child's repetition was the same as E's model on the first attempt. If the child made an error on the first attempt, the following classifications were used for responses to E's corrections: 'E' = entirely corrected, if the child made a complete correction; 'P' = partially corrected, if the child made a partial correction, specifically correcting the originally ungrammatical section of his or her utterance; 'D' = different, if different from both the initial attempt and E's model; 'N' = not corrected, if subsequent attempts were the same as the initial attempt; and 'R' = refusal, if the S refused to attempt subsequent repetitions. These classifications are self-explanatory, except perhaps for 'P', some examples of which are given here.

E: Cats drink milk or water.
S: Cats drink milk and water.
E: Can you say, 'Cats drink milk or water'?
S: Milk or water.
E: Can you say 'Cats drink milk or water'?
S: They drink milk or water.

E: Yesterday Sylvester could catch fish.
S: Yesterday Sylvester can catch fish.
E: Yesterday Sylvester could catch fish.
S: Sylvester could catch fish.

Table 2 presents overall responses. Out of a total of 277 attempts, the Ss responded correctly 157 times (57%); of the 117 instances which were corrected, children responded with a complete correction 53 times (45% of corrected) and with a partial correction 21 times (18%); the utterance was not corrected (including 'D,N,R') 37% of the time. Grouping together the cases in which children made a complete or partial correction ('E,P' = 63%) vs. cases with no correction ('D,N,R' = 37%), a t-test reveals that corrections were made significantly more often than not: $t(7)=6.35$, one-tailed $p<.001$.

Control response types, that is, responses to requests for repetition of a correct utterance, were analyzed separately. Out of a total of 18 such responses, 78% were correct repetitions (that is, the same as the initial correct attempt), 5% were ill-formed repetitions, and 17% were refusals. Thus the great majority of Ss' responses were unchanged utterances; note that Ss responded to adult prompts with

Table 2: Overall Results.

	N	% of overall		N	% of corrected
Initially Correct:	157	57	Eventually Corrected:	53	45
Initially Refused:	3	1	Partially Corrected :	21	18
Initially Incorrect:	117	42	Different :	15	13
			Not Corrected :	14	12
Total N = 277			Refused to Attempt :	14	12

Table 3:
Number and percentage of responses to sentences organized by grammatical category and structures predicted to be learned early vs. late. I=initially correct, E=entirely corrected, P=partially corrected, D=different but not corrected, N=no change, R=refused second attempt.

Grammatical Category	Number Attempted	I #	I %	E,P #	E,P %	D,N,R #	D,N,R %
EARLY							
Modals	57	37	65%	16	28%	4	7%
Questions	35	28	80%	5	14%	2	6%
Conjunctions	39	23	59%	10	26%	6	15%
Aspects	15	12	80%	2	13%	1	7%
Embedding	13	8	62%	3	23%	2	15%
Passives	8	4	50%	3	37.5%	1	12.5%
	167	112	67%	39	23%	16	10%
LATE							
Modals	23	13	57%	3	13%	7	30%
Questions	37	22	59%	10	27%	5	14%
Conjunctions	28	8	28.5%	12	43%	8	28.5%
Aspects	16	8	50%	6	37.5%	2	12.5%
Embedding	15	3	20%	5	33%	7	47%
Causatives	8	5	62.5%	2	25%	1	12.5%
Passives	8	2	25%	4	50%	2	25%
	135	61	45%	42	31%	32	24%

Table 4:
Summary of number and percent of types of corrections for Early vs. Late structures.

	EARLY					LATE				
# Requests for Repair	E,P #	E,P %	DNR #	DNR %		#Requests for Repair	E,P #	E,P %	DNR #	DNR %
55	39	71%	16	29%		74	42	57%	32	43%

unchanged utterances in only 12% of the cases in which the initial utterance had in fact been incorrect.

Responses organized according to grammatical category and structure types predicted to be learned early vs. late are presented in Table 3. (The numbers in this table reflect the fact that some sentences were exemplars of more than one category; for example, *'Can the cat bark?'* is counted in both the 'Yes-No Question' and the 'Modals' categories.) It can be seen from this table that struc-tures predicted to be learned early were in fact produced correctly on the first try by these Ss more often than were the structures predict-ed to be learned later (67% vs. 45%). Table 4 shows that of the 55 instances in which Ss were prompted to make a correction of the 'early' structures, they made a complete or partial correction (E,P) in 71% of the cases. However, when they were prompted to correct one of the 'late' structures, which occurred 74 times, they responded with a correction in only 57% of the cases. Due to the small and irregular numbers in individual cells, statistics were not performed on these data; however, it is clear that the hypothesis that Ss will attempt more corrections on 'easier', i.e. earlier learned constructions, is supported by these results. There are no clear trends across grammatical categories predicted to be learned earlier vs. later (i.e. those at the top vs. bottom of the table).

3.0. Discussion and Conclusions.

The first issue raised above was whether children will interpret a corrected repetition of their incorrect utterance as negative evidence, and whether they will utilize this information to repair their utterance. The data presented here support a positive answer. However, note that for the most part children do <u>not</u> interpret repetition of an initially correct utterance as a request for repair. This indicates that a rather complex mechanism is at work, in that children to not merely change any utterance when an adult prompts a repetition. A possible explanation is that children recognize adult repetitions as a cue that the child's utterance <u>may</u> have been ill-formed; children match their initial utterance against the adult's repetition, and if a mismatch is found, they repair the utterance if they are able to at that point in their development. Clark (1982:177) similarly argues that children's repairs 'provide evidence for an ability to detect mismatches between some representation of what an utterance should have sounded like and the child's own version. Otherwise children would be unable to repair on demand, and repair appropriately, when asked to.'

The second question posed here is whether children's ability to utilize adult corrections reflects some developmental progression. Again these results support a positive answer, in that those struc-tures which Ss tended to be able to produce correctly on their first attempt (the 'early' structures) were also those which they were more able to correct if produced incorrectly the first time. The 'late' structures posed more problems for both initial attempts and correc-tions. Specific statements about individual grammatical categories would be somewhat equivocal at this point, but the trend can be seen within every category tested. Clearly more precise data depends on further studies with larger numbers of children of a broader age range, focussing on specific grammatical structures.

What does this research say about the broader issues of negative evidence and innateness? Innateness theories of language acquisition take the stance that adults rarely give children overt feedback on the syntactic correctness of their utterances (using B&H for support), and that even if they do, children cannot utilize this information to make repairs (as the McNeill anecdote is taken to show). However, there is a growing body of evidence that adults do respond differentially to children's syntactically correct vs. incorrect utterances. Hirsh-Pasek et al. (1984) shows that this response can take the form of corrected repetitions of incorrect utterances, and the present research shows that children utilize these repetitions as a cue to engage a sort of 'monitor-checker-repair' mechanism (as described in Clark 1982:173). It is evident that requests for repairs can take forms other than repetitions: Gallagher (1977, 1981) has shown that adults often demonstrate misunderstanding of a child's utterance by asking 'What?' or (e.g.) 'You can what?', and that children take these sorts of responses as an indication that the repair mechanism needs to be switched on. Children's responses to such 'contingent querys' and repetitions show that *they are being used as negative evidence*, i.e. as evidence of the (potential) ungrammaticality of the child's utterance. Further, since this type of adult response actually facilitates the communication situation (i.e. the conversation cannot continue if the adult does not understand what the child is trying to say), it is not surprising to find these adult responses to be much more prevalant than overt corrections, which effectively halt the communication process (the child in McNeill's example still believes that nobody likes him by the end of the exchange). The extent to which children actually utilize this negative evidence to make long-term changes in their grammars is a question only detailed longitudinal studies can answer. Nevertheless, there is now ample evidence to show that in general, children are presented with several types of negative evidence in their normal language acquisition environments (what child is *never* misunderstood by adults?), and that they can utilize this negative evidence as such. If the necessity for positing a large language-specific innate component for language acquisition hinges on the argument that the language acquisition environment does not provide all the necessary or sufficient information for constructing a grammar, then studies such as the present one begin to weaken this necessity. Instead, they would support a theory such as that outlined in Bruner 1983, that children's basic non-language-specific cognitive abilities, combined with their inherent desire to communicate, would allow them to utilize evidence such as that discussed here to construct the correct grammar for their language.

FOOTNOTES

[1] An earlier version of this paper was prepared and presented by the first author at the 18th Annual SCLRF. The modifications evident in the current version represent a collaboration by both authors. This research was funded in part by a U.C. Davis Faculty Research Grant to Jaeger, and was carried out at the U.C. Davis Early Childhood Laboratory Pre-School. We wish to thank Eve Clark, Kim Plunkett, and Janet Shibamoto for comments on this study, and Nancee Baily and the children at E.C.L. for their cooperation.

[2] The order in which children chose the pictures turned out not to be random, in that pictures 1, 2, and 5 were selected earlier than pictures 3 and 4 a significant number of times. Analysis of overall patterns in the children's responses showed that this factor had no effect on the results, in that children did not tend to perform any better or worse on pictures chosen earlier vs. later.

REFERENCES

Bowerman, M. 1979. The acquisition of complex sentences. In Fletcher & Garman, pp. 285-305.

Brown, R. & C. Hanlon. 1970. Derivational complexity and order of acquisition in child speech. In: J.R. Hayes (ed.), *Cognition and the development of language*, New York: Wiley.

Bruner, J. 1983. *Child's talk; Learning to use language*, New York: Norton.

Clark, E. 1982. Language change during language acquisition. In: M.E. Lamb & A.L. Brown (eds.), *Advances in developmental psychology, Vol. 2*. Hillsdale, N.J.: L. Erlbaum, pp. 171-195.

Fletcher, P. 1979. The development of the verb phrase. In Fletcher & Garman, pp. 261-284.

Fletcher, P. & M. Garman (eds.). 1979. *Language acquisition; Studies in first langauge development*, Cambridge University Press.

Gallagher, T. 1977. Revision behaviors in the speech of normal children developing language. *JSHR* 20:303-318.

Gallagher, T. 1981. Contingent query sequences within adult-child discourse. *J. Child Lg.* 8:51-62.

Garman, M. 1979. Early grammatical development. In: Fletcher & Garman, pp. 177-208.

Gold, E.M. 1967. Language identification in the limit. *Information and control* 10:447-474.

Hirsh-Pasek, K., R. Treiman, & M. Schneiderman. 1984. Brown and Hanlon revisited: Mothers' sensitivity to ungrammatical forms. *J. Child Lg.* 11:81-88.

Karmiloff-Smith, A. 1979. Language development after five. In: Fletcher & Garman, pp. 307-323.

McCawley, J. 1979. Some ideas not to live by. In: J. McCawley, *Adverbs, vowels and other objects of wonder*, Chicago Univ. Press, pp. 234-246.

McNeill, D. 1966. Developmental psycholinguistics. In: F. Smith & G. Miller (eds.), *The genesis of language: a psycholinguistic approach*, M.I.T. Press, pp. 15-84.

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Understanding Natural Kinds: A Developmental Comparison

Susan A. Gelman
University of Michigan

Ellen M. Markman
Stanford University

Categories named by language often capture more than the obvious properties that people already know; they also capture a richer basis of similarity that is not likely to be known by casual inspection. For example, in addition to more superficial features, such as shaggy fur and four legs, most dogs share a particular diet, life expectancy, and DNA structure. Many of the features in common to dogs may not even be known by the average person. In fact, with some objects known or obvious properties are a poor guide to internal structure, and may actually result in a misleading classification. Whales, for example, used to be classified as fish because of their behavior and appearance, but were later reclassed as mammals on the basis of more subtle clues.

Many words in English name categories with a rich, correlated structure, especially words for natural kinds. "Natural kinds" are naturally occurring phenomena such as animals, plants, and minerals. Often what is behind our uses of natural kind terms are scientific theories. For example, we have a theory of biology that considers internal parts to be more important than outer appearances, so we classify whales as mammals rather than as fish. Not all words capture such rich similarities. For example, red things have just a single property in common, and mittens have little in common beyond the obvious. Nonetheless, this quality of capturing deep underlying similarity is pervasive in language (see Kripke, 1971, 1972; Putnam, 1970, 1973; Quine, 1969; Schwartz, 1977, 1979 for further discussion).

There is an interesting developmental problem underlying children's use of natural kind terms. Children start to learn natural kind terms at a very young age, beginning with their first few words (e.g., _duck_, _flower_; see Nelson, 1973). Yet at that age children simply do not have the scientific knowledge to understand why these categories extend beyond appearances. Moreover, young children are often misled by appearances. On a wide range of cognitive tasks: memory, quantitative reasoning, perspective-taking, children have a strong perceptual bias (cf. Flavell, 1985). How, then, do children understand natural kind terms? Do children expect these words to share underlying similarities? Or is there a developmental shift in how such terms function over time?

We explored these questions in previous research with 4-year-old children (Gelman & Markman, in press), and began with the question of whether children believe that members of a category share non-obvious features. In other words, to what extent do children rely on natural kind categories to guide their inductions? We presented children with a series of problems of the following sort. Children saw three pictures at a time, for example, a flamingo, a bat, and a blackbird. Two of the pictures were from the

same category (e.g., the blackbird and the flamingo). Two of the pictures look alike (the blackbird and the bat). The experimenter first labeled the pictures. Then children heard a new fact about two of the pictures, and a question about the third, for example, "This bird [pointing to the flamingo] gives its baby mashed-up food; this bat gives its baby milk. [Pointing to the blackbird:] Does this bird give its baby mashed-up food, like this bird, or milk, like this bat?"

The issue was whether children base their inductions on the category or on the appearances. There were at least two plausible patterns of results. On the one hand, children could draw inferences based on perceptual similarity. For example, they could decide that the blackbird and the bat feed their young the same kind of food. This would be consistent with their lack of scientific knowledge and with their usual perceptual biases. A second possibility is that even preschoolers recognize the importance of category names for induction. Young children may have a primitive understanding of how categories are organized, even before they can back up their beliefs with solid scientific evidence.

We found that category labels in fact exerted a powerful effect. Sixty-eight percent of the time, 4-year-olds preferred to draw inferences on the basis of category membership even though it was pitted against striking perceptual similarity. For example, they claimed that the blackbird gives its baby mashed-up food, like the flamingo. We replicated the study with a second group of 4-year-olds; they based their inferences on category membership 73% of the time. Performance in both studies was well above chance. So, despite their known perceptual biases and their rudimentary scientific knowledge, 4-year-olds realize that members of a kind share underlying similarities.

The major purpose of the present study is to examine natural kind concepts in even younger children. Even within the narrow age range from 3 to 4 years of age, children are learning a great deal about language and about categories of objects. If knowledge and experience are responsible for children's performance, then younger children should rely less on category membership than older children for drawing inductive inferences. On the other hand, children may assume from a very early age that categories are structured like natural kinds. If so, then 3-year-olds should already favor categories over outer appearances to support inductions.

Method

Subjects. 104 children (53 girls and 51 boys) from six preschools in California and Michigan participated: 50 3-year-olds (range: 3-0 to 3-11; mean age 3-6) and 54 4-year-olds (range: 4-1 to 4-11; mean age 4-7). The three conditions were roughly balanced for age and sex. Four additional 3-year-olds were tested but did not complete the session and so were dropped from the study.

Procedure. Previous studies (Gelman & Markman, in press) were too demanding for those below age 4. Children were asked to consider

three pictures at a time and learn two new facts. In pilot-testing, 3-year-olds simply could not remember all of that information. Therefore, a simpler task was devised that 3-year-olds would understand. Instead of seeing three pictures at a time, children saw just two. Instead of learning two new facts, they learned just one. For each set of pictures the experimenter first presented the target picture, labeled it, and taught the child a new fact about it. For example, if the target was a snake, the experimenter said, "See this snake? This snake lays eggs." Then the child saw four test pictures, one at a time and in random order. (1) One was of the same category and appearance as the target (e.g., another small, brown snake). (2) One was of the same category but of different appearance (e.g., a large gray cobra). (3) One was of a different category but similar in appearance to the target (e.g., a small brown worm). (4) Finally, one was of a different category and a different appearance (e.g., a cow). Children saw only one of the test pictures at a time, in conjunction with the target.

For each new picture, children were asked whether the animal lays eggs like the target snake. The critical comparison is between the second and third test pictures. If children draw more inferences to the cobra, then category membership is more powerful. If they draw more inferences to the worm, then appearances are more powerful. Or, children could draw inferences equally to the two pictures.

Each child saw 10 sets of pictures. All of the categories were natural kinds. For the sake of generality, half of the items were animals (such as cats and bugs) and half were inanimate (such as sugar and gold). Children were taught "deep" properties -- that is, ones that are enduring and true of the entire category. Also, the new facts were designed to be interesting to children, but not ones that they already knew.

We also included two other conditions, to provide a basis of comparison. Children in those conditions were given only names or only pictures. In the Word Only Condition, exactly the same set of pictures were used as in the previous condition. The only difference was that children did not see the first picture. The experimenter held the target card so only she could see the front. The child saw only the back. All other pictures were visible, and all were named. Thus, the only explicit basis for making inferences was the name. In the Picture Only Condition, again the same set of pictures were used as in the other conditions. Here, the only difference was that children did not hear any names. Children saw all pictures; the only explicit basis for making inferences was the appearance.

Results

A 5-way ANOVA was conducted including age, condition, domain (animal versus inanimate), category (same or different from target), and appearance (same or different from target). A 5-way item-by-item ANOVA was also conducted, to determine whether the

results generalize across items as well as subjects. The two analyses were then combined using the min-F' statistic (Clark, 1973). The results are presented in Figures 1 through 3. Overall, children drew more inferences to members of the same category than to members of different categories, min-$F'(1,25) = 105.07$, $p < .0001$, and to objects of similar appearance than to objects of different appearance, min-$F'(1,21) = 45.09$, $p < .0001$. However, the main question of interest concerns how these effects were mediated by the condition and the age of the child. As expected, many of the relevant interactions were significant. Children's patterns of inferences varied with condition: category x condition interaction, min-$F'(2,73) = 3.25$, $p < .05$; appearance x condition interaction, min-$F'(2,40) = 18.51$, $p < .0001$; category x appearance x condition interaction, min-$F'(2,57) = 3.70$, $p < .05$. Children based more inferences on category membership when only the label was provided, and more on appearances when only pictorial information was provided. Interestingly, there were no developmental changes in the patterns of children's inferences, on a min-F' analysis. It is easiest to understand these interactions by considering each condition separately.

Figure 1.

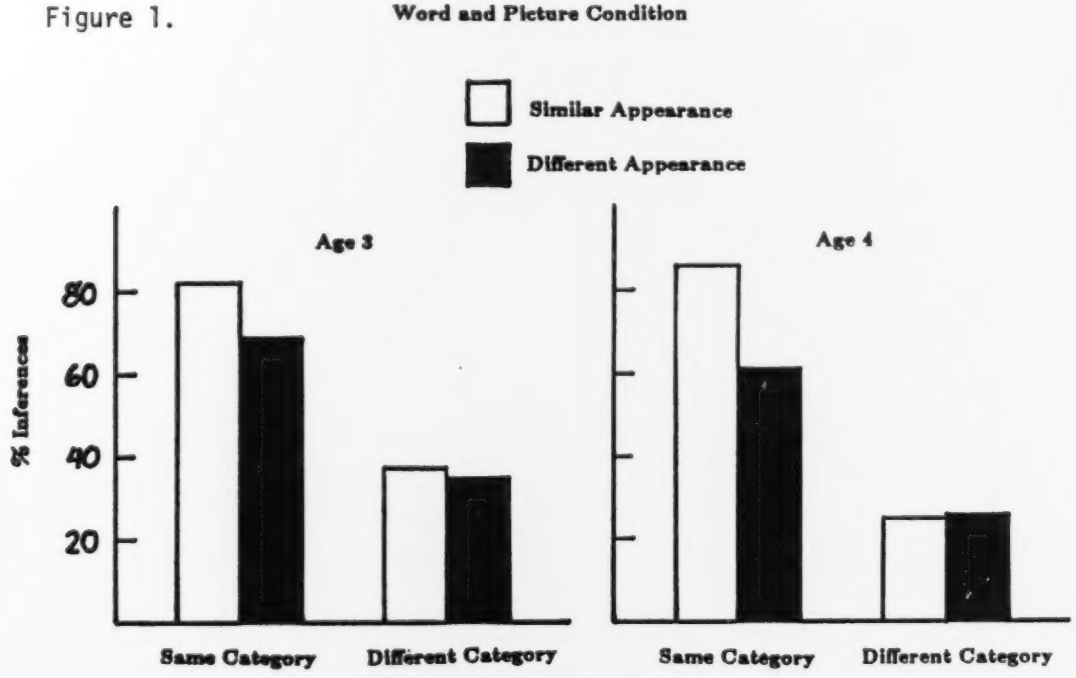


Figure 2.

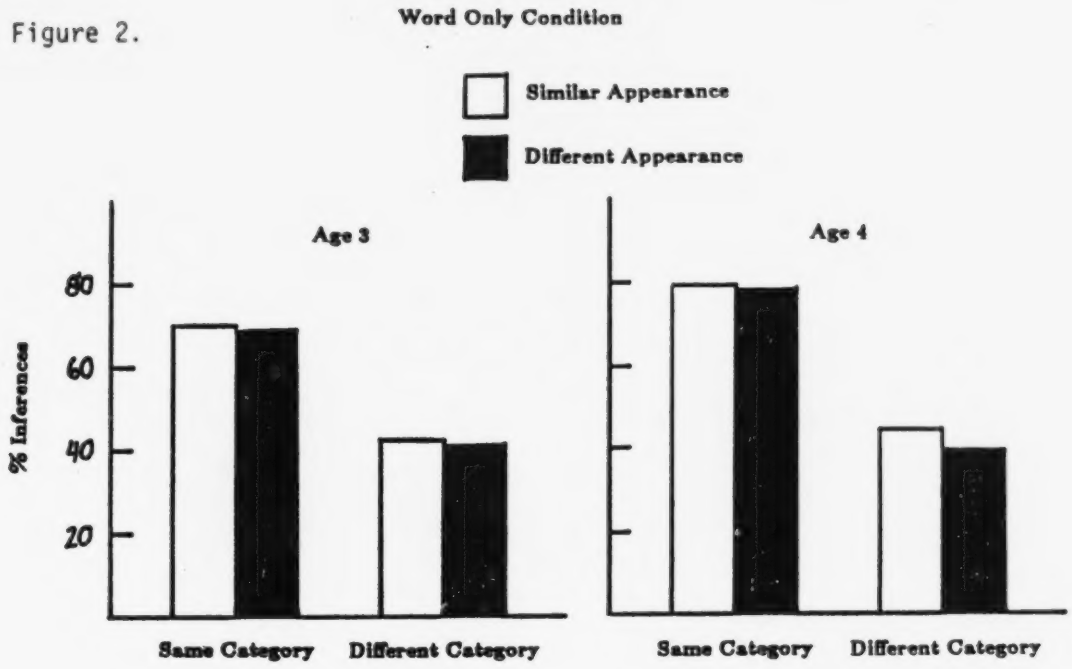
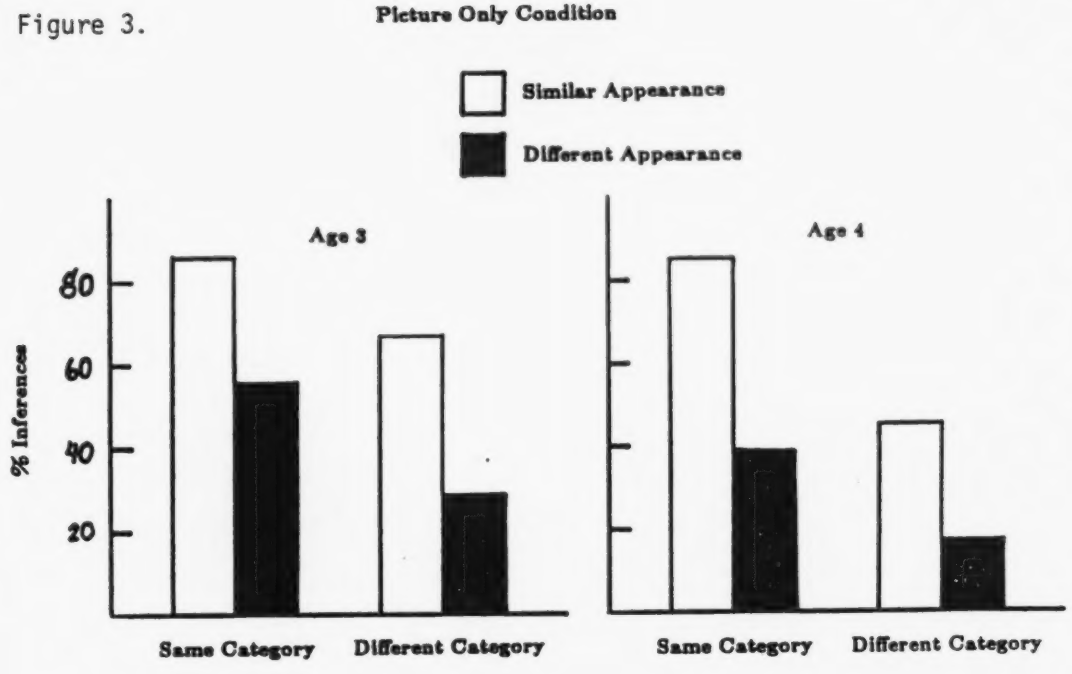


Figure 3.



Word and Picture Condition. In this condition, children saw the objects and heard them labeled. Figure 1 shows how often children drew inductions from the target pictures (e.g., how often they said that a particular animal lays eggs). The category labels were especially powerful in directing children's inferences. Children consistently drew more inferences when categories were identical than when they differed. In fact, they drew more inferences to pictures that matched on category alone (mean = 64%) than to pictures that matched on appearances alone (mean = 29%), $p < .002$ at each age. For example, they were much more likely to say that a cobra lays eggs than that a worm lays eggs. In fact, this pattern held up on every one of the 10 items. The most interesting result in this condition is that there are no developmental differences. The category is a powerful source of information for children, even by age 3.

Word Only Condition. Results are shown in Figure 2. In this condition the target picture in each set was labeled, but children never saw it. As expected, children strongly based their inductions here on category labels: they tended to say that the snakes lay eggs, for example, but that the worm and the cow do not. The appearances, which weren't fully available to the children, had no effect. This pattern held up on every item at both ages.

Picture Only Condition. Children saw all of the pictures but never heard names for them. In this condition, children answered quite differently, depending on the item. On some problems, especially the inanimate items, children based their answers on appearances. But on other items, especially the animal items, children based their answers on the categories. Children never heard what the pictures are called; nevertheless they often based their answers on category membership.

Figure 3 presents the results, collapsed across items. In some cases children may have been able to figure out the category labels. For example, when children saw a leaf-insect, they may have realized that it was an animal because it had a head, feet, and antennae. When children then saw the leaf, despite its similarity to the leaf-insect, they would have known it was not an animal because it lacked a face and legs. On other items, though, the category would have been harder to figure out from a picture alone. For example, a reddish mass could be clay, dirt, or sand.

There is some evidence for this interpretation from children's spontaneous comments. Children at both ages frequently named the category after answering the yes/no question. For example, one child said, "Because it's a bird!"; another explained, "They're both shells." One 3-year-old correctly denied that one white-striped furry creature (a skunk) could see in the dark like another white-striped furry creature (a cat), explaining, "It's not a kitty, it's a baby horse." We had not provided any of these labels.

So it seems that children often figured out what categories these pictures belonged to, even in the absence of labels. They then used the categories as the basis of their inductions. To test this idea more directly, we asked a second group of children simply

to name each picture used in the study. Children were shown all of the pictures, one at a time, and simply reported what they thought each one was called. We computed a rank-order correlation between children's accuracy in naming each item, and the number of inferences to that item, when no labels were provided. The Spearman rho correlation between naming and inferencing was .77, $p < .05$. It seems that when children see only the appearances, they invoke the category labels, then use them to decide which things share underlying similarities.

Discussion

In this work we have examined how natural kind terms promote inferences above and beyond outer appearances. Children as young as we could test assume that objects with the same name share underlying similarities. This was shown in three ways. First, when given just labels, children as young as age 3 use them as the basis for drawing inductions. Second, when labels and appearances conflict with each other, children rely more on labels than on appearances for drawing inductive inferences. This was true for both the animals and inanimates, so it seems to be a fairly general assumption that children have by age 3.

The third finding is that even when no labels were provided for the pictures, children sometimes figured out what categories they belonged to. They then used the inferred labels to decide about other properties. The categories were never explicitly mentioned, yet they continued to be salient.

Our data clearly indicate that children are sensitive to the power of language for organizing and extending knowledge. Consequently, much knowledge gets passed down implicitly through the system of categories named by language. Furthermore, this work highlights that an especially important function of language is to make reference. Words that refer -- including common nouns -- accomplish at least three things: they identify particular objects, they imply that objects are grouped into kinds, and they foster inductions. It is a remarkable fact that children grasp all three aspects of this function of language.

In fact, children are drawing inferences at such an early age, they may start out with a general assumption that categories named by common nouns promote inductions. With development, they would then have to refine this assumption and limit it to properties and category types that are appropriate. Other expectations about the structure of natural language categories also appear quite early. For example, children as young as age 1 or 2 assume that proper nouns map onto individual objects, whereas common nouns refer to categories of objects (Gelman & Taylor, 1984). The assumption that common nouns promote rich inductive inferences could be another early expectation, one that helps children acquire category terms rapidly and efficiently.

References

Clark, H. (1973). The language-as-fixed-effect fallacy: A critique of language statistics in psychological research. Journal of Verbal Learning and Verbal Behavior, 12, 335-359.

Flavell, J. H. (1985). Cognitive development, 2nd ed. Englewood Cliffs, NJ: Prentice Hall.

Gelman, S. A., & Markman, E. M. (in press). Categories and induction in young children. Cognition.

Gelman, S. A., & Taylor, M. (1984). How two-year-old children interpret proper and common names for unfamiliar objects. Child Development, 55, 1535-1540.

Kripke, S. (1971). Identity and necessity. In M. K. Munitz (Ed.), Identity and Individuation, New York: New York University Press.

Kripke, S. (1972). Naming and necessity. In D. Davidson & G. Harman (Eds.), Semantics of natural language. Dordrecht: D. Reidel.

Nelson, K. (1973). Structure and strategy in learning to talk. Monographs of the Society for Research in Child Development, 38(1-2, Serial No. 149).

Putnam, H. (1970). Is semantics possible? In H. E. Kiefer & M. K. Munitz (Eds.), Language, beliefs, and metaphysics. New York: State University of New York Press.

Putnam, H. (1973). Meaning and reference. The Journal of Philosophy, LXX, 699-711.

Quine, W. V. (1969). Natural kinds. In W. V. Quine, Ontological relativity and other essays. New York: Columbia University Press.

Schwartz, S. P. (1977). Introduction. In S. P. Schwartz (Ed.), Naming, necessity and natural kinds. Ithaca, NY: Cornell University Press.

Schwartz, S. P. (1979). Natural kind terms. Cognition, 7, 301-315.

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Children's Sensitivity to the Contrastive Use of Object Category Terms

Jean Hutchinson
Vanderbilt University

In order for children to successfully converge on the correct meaning of a word in a limited amount of time, constraints must exist on their hypotheses about word meanings. Eve Clark has recently proposed that children follow a Principle of Contrast--that is, they assume that every two forms contrast in meaning (Clark, in press). If children are sensitive to the ways in which words contrast, this should help them to acquire and generalize words appropriately. One kind of contrast that children may be sensitive to is that between category terms: category terms are often mutually exclusive (Markman, 1984). For example, an object cannot be both a cow and a horse. The group of objects labeled by "cow" does not include any objects labeled by "horse" and vice versa.

Note that if a child makes the assumption that category terms are mutually exclusive, she will be confused when an adult tells her that a cow is also an animal. In fact, there is evidence from Macnamara (1982) and others that 2- to 3-year-old children sometimes resist labeling an object they already know another word for with a superordinate word like animal. Eventually, children will have to discover what the correct dimensions of contrast are, for pairs of words that co-refer, such as animal and cow, or vehicle and car. But the assumption that category terms are mutually exclusive would be correct for the basic level words that children tend to learn first.

There are at least two ways that use of mutual exclusivity might help in learning object category terms. It might help children to correct their overextensions of words. For example, if a child calls a cow "horsie" and is subsequently told that the cow is a "cow," she will assume that "horsie" and "cow" contrast and so be unwilling to accept both "horsie" and "cow" as labels. At first she might reject "cow" and keep her original label, but as evidence accumulates, she will eventually correct her overextension of "horsie" and accept "cow." There may be an intermediate period when she uses both words because she is not sure which word is correct. But mutual exclusivity will operate as a driving force to cause the child eventually to eliminate one word or the other.

There is a second way that mutual exclusivity might help in word learning. It might help the child decide what the speaker is referring to in the first place, when she points to a scene and labels an object in that scene. Pointing is often ambiguous. The child may not be sure what the speaker is referring to. But if she can rule out objects she already knows words for as referents of the new word, then she has a good start in making an initial mapping of the word onto the correct object.

The present experiment was designed to test whether very young children use mutual exclusivity to make an initial link between a word and an object. When first interpreting a new word, do children make

mistakes that violate the mutual exclusivity principle, or do they seem to have the knowledge that different words refer to different objects? I was interested in finding out whether children change with age in sensitivity to mutual exclusivity. I was also interested in whether there are intelligence related differences in this sensitivity.

Six groups of children took part in the study, 14 in each group, for a total of 84 children. Three groups were normally developing children at three different ages. The youngest were late 1-early 2 years of age, the middle group was about 2½ years old, and the oldest group consisted of 3-year-olds. All the children were given the receptive portion of the Sequenced Inventory of Communication Development, or SICD. This is a 20-minute standardized test that measures how well children understand words and simple commands. The normal children scored approximately at their age level on the SICD: the youngest scored at the 20-24 month level, the middle group scored at the 28-32 month level, and the oldest group scored at the 36-44 month level.

The other three groups of children were mildly to moderately retarded. They were matched to the normal children on their receptive scores on the SICD. Of course, even though their receptive language was the same, they were older. The 20-24 month level group had a mean age of 4 years, 2 months, the 28-32 month level group a mean age of 6 years, 5 months, and the 36-44 month level group a mean age of 5 years, 11 months.

The main task given to children was very simple. Children were shown pairs of pictures of objects, each pair on a separate page of a picture book. Each pair consisted of one object whose name the children knew (e.g., shoe) and one object with an unknown name (e.g., metronome). Children were asked to touch the unfamiliar object (e.g., "Touch the metronome"). If children assume that different words contrast in meaning, they should assume that "metronome" refers to an object they do not already know a word for, and so choose correctly. If they do not choose correctly--if they choose the shoe when they are asked for a metronome--then they are violating the mutual exclusivity principle.

Five unfamiliar/familiar pairs were used in the study: metronome/shoe, massager/baby, bellows/car, pump/kitty cat, and grinder/dog. Children's receptive knowledge of the words for all of these items was pretested to be sure they understood words for all the familiar items and did not understand words for all the unfamiliar items. This pretest will be discussed further later. In the mutual exclusivity task, children saw each pair of pictures twice, and they were scored as correct for a pair only if they were correct on both trials.

We would like to be able to claim that children choose an unfamiliar object because they know that the new word must refer to something they do not already have a word for. But children could simply select unfamiliar objects because they are novel, and they like them better. To try to rule out the possibility that they might choose unfamiliar objects just on the basis of salience, children were given

a pretest in which they were shown the same five pairs of pictures used in the main mutual exclusivity task. For each pair, children were simply asked to "Pick one." These neutral instructions were designed to get them to pick the one they liked, that they found most salient. Children were shown each pair twice. If a child preferred the unfamiliar object on both trials, then that object was assumed to be particularly salient for her, and the results for that object pair were not counted in the analysis of the main mutual exclusivity task.

On average, children did not find the unfamiliar items very salient. They preferred a mean of less than 1 of the unfamiliar items. The modal number of pairs dropped from a child's results because of salience of the unfamiliar item was one pair out of the five.

The results for the mutual exclusivity task are shown in Figure 1. The graph depicts the percentage of pairs that children got correct--that is, the percentage of pairs for which children chose the unfamiliar item on both trials. Chance performance is 25% (50% correct on the first trial x 50% correct on the second trial). The nonretarded (NMR) children did very well; all three groups performed well above the chance level. The late 1-early 2 year-olds got 68% correct, the 2½-year-olds got 86% correct, and the 3-year-olds got 95% correct. There was a slight improvement with age: The youngest group performed significantly worse that the oldest group (Newman-Keuls test, $p < .05$). None of the other pairwise comparisons among the normal groups were significant.

To try to pinpoint more exactly when children begin to follow the mutual exclusivity principle, I looked more closely at the youngest group. In this group, there were 4 children who scored at the 20-month level and 10 children who scored at the 24-month level on the SICD. (The SICD is scored in 4-month increments.) The average performance of the ten 24-month level children was 80% correct, which is not significantly different from either of the two older groups. It appears that the ability to exclude a familiar object and correctly choose an unfamiliar object as the referent of a new word is just starting to come in around 20 months, and is almost complete by 24 months.

The two highest level retarded (MR) groups were comparable to the matched normal groups. The retarded children who scored at the 2½-year level on the SICD got 91% correct, and the children who scored at the 3-year level got 92% correct. The 20-24 month level retarded group, however, did much more poorly. They only got 32% correct, which was not different from chance. These children did significantly worse than the matched 20-24 month level nonretarded children [$t(26) = -2.56$, $p = .017$] and indeed were significantly worse than any other group.

To summarize the results so far, normally developing children as young as late 1 were able to rule out one object they already knew a word for, and correctly pick a novel object as the referent of a new word. In contrast, 3- to 4-year-old retarded children who were functioning at the late 1-year level had particular difficulty with this strategy. Not until retarded children reached the 28-month level in receptive language did they systematically look for an object

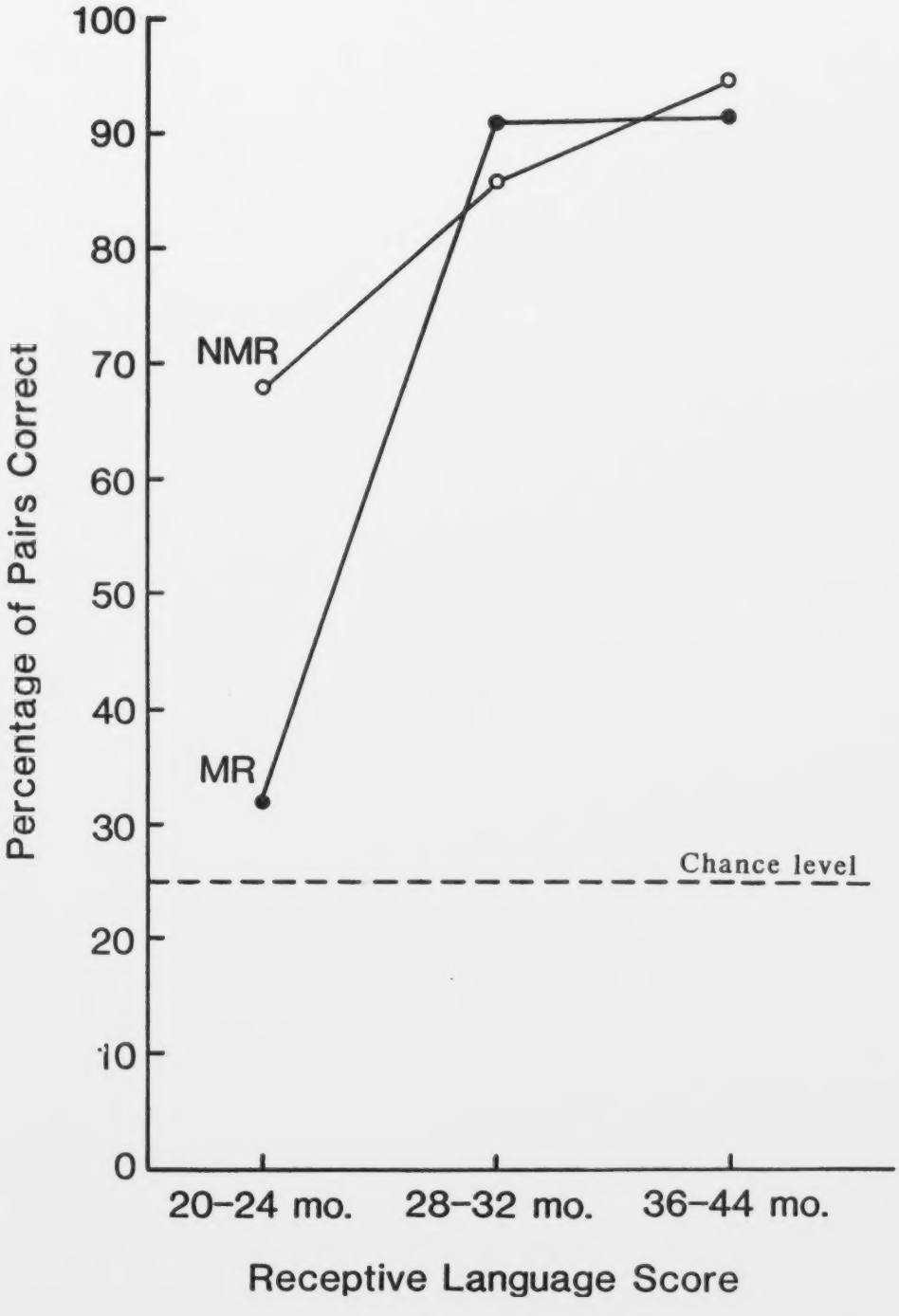

Figure 1. Percentage of stimulus pairs correct for MR and NMR children in mutual exclusivity task.

they did not know a word for when they heard a new word.

Word learning situations are not always as simple as the two-choice situation presented in the mutual exclusivity task. Often the scene is complex with many objects present. Suppose, for example, that three unfamiliar objects and one familiar object are present. Would normal children as young as 20-24 months still refrain from picking the familiar object when they heard an unfamiliar word? It happens that the pretest of receptive knowledge of the five unfamiliar words took just this form. In the pretest, children were shown four pictures: an unfamiliar target object (e.g., metronome) paired with a familiar object (e.g., shoe) as before, but with two additional unfamiliar distractors. They were asked to "touch the metronome." If children use the mutual exclusivity principle, they should refrain from picking the familiar distractor, or shoe, when asked for a metronome. Each word was tested twice, and the percentage of trials on which children chose the familiar object was determined.

The results are shown in Figure 2. The two oldest groups of nonretarded subjects rarely chose the familiar object. The 2½-year-olds chose the familiar object 5% of the time and the 3-year-olds chose the familiar object 0% of the time. The two highest-level groups of retarded subjects likewise followed the mutual exclusivity principle: the 28-32 month level and 36-44 month level children chose the familiar object 4% and 3% of the time, respectively. All four of these higher level groups chose the familiar object significantly less often than 25% of the time, the frequency that would be expected by chance.

At the 20-24 month level, however, both normal and retarded children performed at chance. They did not refrain from choosing the familiar object when they heard an unfamiliar word. The normal 20-24 month level children picked the familiar object 23% of the time, and the retarded 20-24 month level children picked the familiar object 27% of the time.

Note that in this task, the 20-24 month level normal children appear not to be following a contrastive strategy, whereas in the two-choice situation they did follow a contrastive strategy. I believe that the addition of the two extra unfamiliar objects simply overwhelmed these young children--there was no clear right answer, so they picked randomly. Thus even though these children clearly had knowledge of the contrastive use of words, they could not make use of this knowledge in situations with several possible referents. Twenty-eight-month level children, however, were able to use their knowledge of mutual exclusivity in the more complex mapping task.

In summary, making the initial mapping between a word and a referent is an essential part of inducing word meaning. Children learn a tremendous number of words in a very short time (Carey, 1979). One mechanism that may help children to do this is their assumption that different words refer to mutually exclusive categories. Given a choice between a novel object and a familiar object, children as young as late 1 correctly choose the novel object as the referent of a new word. By 28 months, children who are

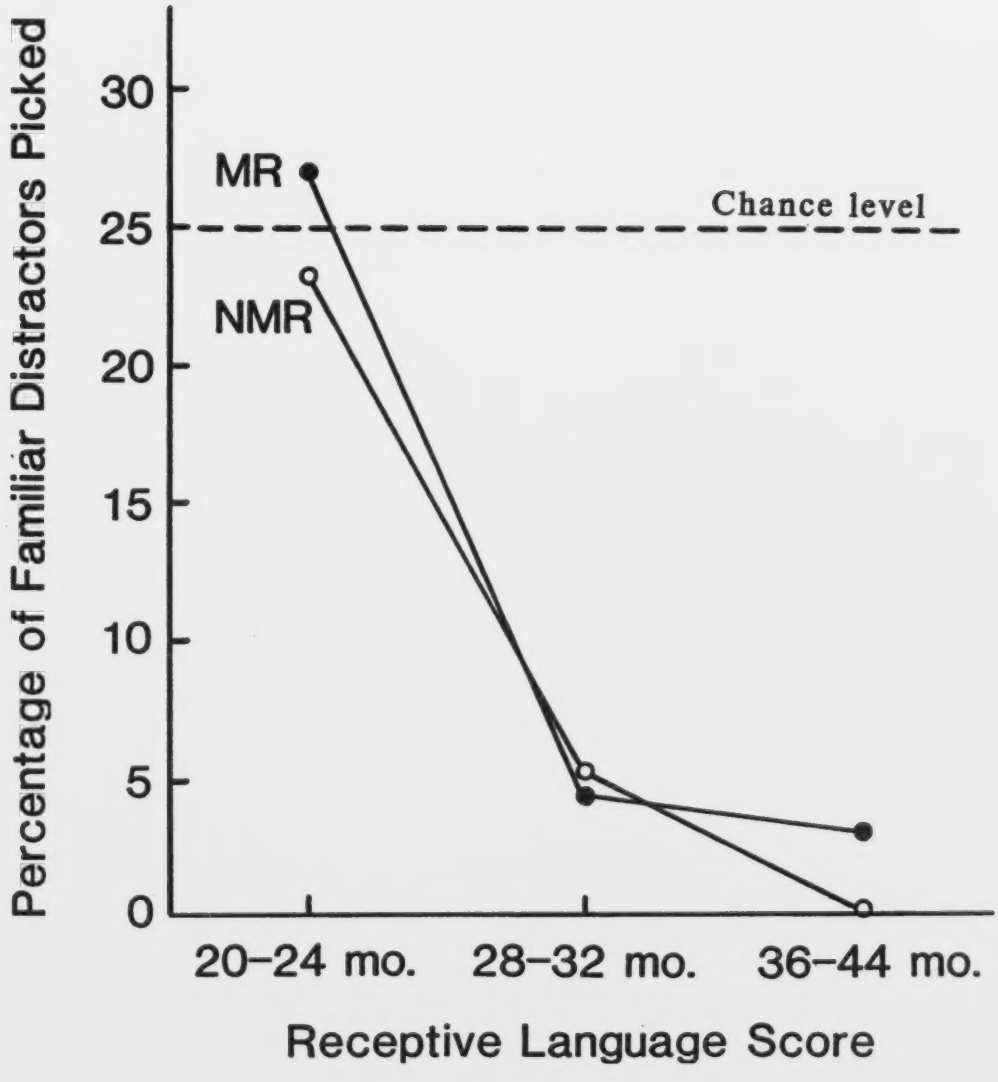

Figure 2. Percentage of familiar distractors picked by MR and NMR children in receptive pretest of unfamiliar words.

presented with three novel objects and one familiar object are able to correctly refrain from picking the familiar object when they hear a new label. In a related study, Golinkoff, Hirsh-Pasek, Baduini, and Lavallee (1985) recently found that 2½-year-olds will exclude three familiar objects and pick an unfamiliar object when they hear a new word. In sum, very young normal children do seem to use the mutual exclusivity principle in making an initial link between a word and an object, at least when the number of objects present is small.

The finding that young retarded children have particular difficulty with the mutual exclusivity principle is especially intriguing, given the possible importance of this principle for rapid and efficient word-learning. These children are relatively slow language learners, and may take as long as a year or more to make 4 months progress. Without the ability to make use of general learning strategies such as the mutual exclusivity assumption, these retarded children may only be able to pick up words that are presented in an exceptionally clear and unambiguous way. It is possible that the mutual exclusivity assumption, as well as other constraining assumptions, are necessary for language development to proceed at a normal pace.

References

Carey, S. (1979). The child as word learner. In M. Halle, J. Bresnan, & G. Miller (Eds.), Linguistic theory and psychological reality (pp. 264-293). Cambridge, MA: MIT Press.

Clark, E. (in press). The principle of contrast: A constraint on language acquisition. In B. MacWhinney (Ed.), Mechanisms of language acquisition: The 20th Annual Carnegie Symposium on Cognition. Hillsdale, NJ: L. Erlbaum Assoc.

Golinkoff, R. M., Hirsh-Pasek, K., Lavallee, A., & Baduini, C. (1985, October). What's in a word?: The young child's predisposition to use lexical contrast. Paper presented at the Boston University Conference on Child Language, Boston.

Macnamara, J. (1982). Names for things: A study of human learning. Cambridge, MA: MIT Press.

Markman, E. M. (1984). The acquisition and hierarchical organization of categories by children. In C. Sophian (Ed.), Origins of cognitive skills: The 18th Annual Carnegie Symposium on Cognition (pp. 376-406). Hillsdale, NJ: L. Erlbaum Assoc.

PRCLD 25
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Acquisition of Quantificational Scope in Mandarin Chinese

Thomas Hun-tak Lee
City Polytechnic of Hong Kong & UCLA

Introduction

In the theory of Government and Binding, a rule of Quantifier Raising (QR) maps from S-structure to Logical Form (LF), adjoining quantifier phrases to maximal projection nodes. QR allows quantifier scope ambiguity to be represented at the level of LF. Given a sentence such as (1), the rule QR as formulated in May (1977) will derive two well-formed LF representations, as in (2) and (3).

(1) [Every child]$_1$ is eating [a cake]$_2$

(2) [[Every child]$_1$ [[a cake]$_2$ [t_1 is eating t_2]$_S$]$_S$]$_S$

(3) [[a cake]$_2$ [[every child]$_1$ [t_1 is eating t_2]$_S$]$_S$]$_S$

In (2), the quantified noun phrase "every child", which c-commands "a cake", takes wide scope over the latter, so that the sentence could mean the children are eating different cakes. In (3), however, "every child" is c-commanded by "a cake", and therefore has narrow scope: the interpretation must be one where the children are sharing the same cake. The scope relations in the two LF representations are given informally in (2a) and (3a).

(2a) For every x, x=child, there exists a y, y=cake, such that
x is eating y

(3a) There exists a y, y=cake, such that for every x, x=child
x is eating y

From an ontogenetic pont of view, QR is of special interest because unlike syntactic movement rules relating Deep Structure and S-Structure, the rule of QR does not involve overt movement, and the child therefore does not appear to have overt evidence for postulating it. QR, in other words, does not seem to be learnable and may be a rule of Universal Grammar (Hyams 1984). If this hypothesis is correct, one may conjecture that children in very early years will have QR in their grammars, and that the early syntactic behavior of children should not show any bias in terms of interpretation of quantificational scope: with sentences such as (1), both wide and narrow scope interpretations should be possible in early child language.

Aims and Method

The present study explores these implications of QR by examining how Mandarin-speaking children interpret sentences involving the universal quantifier mei "every" , the quantificational adverb dou "all" and numeral phrases of the form [one+classifier +noun], as given in (4)-(6) below.

(4) [xiongmao] dou shuijiao le
panda all sleep asp./part.
"(The) pandas have all fallen asleep"

asp.=aspect marker
part.=sentence-final particle

(5) [meige xiongmao] dou shui le
every-CL panda all sleep asp./part.
"Every panda has fallen asleep"

(6) [meige xiaomao] dou zuo zai [yige hezi] li
every-CL kitten all sit at one-CL box in
"Every kitten sits in a box"

The adverb dou must occur in perverbal position following subject/topic noun phrases in a clause, and quantifies all NPs preceding it (Li and Thompson 1981:336). It assigns universal scope to the noun phrase it quantifies. Thus in

(4), dou quantifies the subject NP xiongmao "panda" and the entirety of the set of pandas referred to is predicated upon. It is possible to use dou in conjunction with the universal quantifier mei "every", as can be seen from (5), which is essentially synonymous with (4). While both (4) and (5) contain only one quantified noun phrase, (6) consists of two quantified noun phrases. The relative scope of quantifiers in Chinese is in general determined by surface structure c-command properties. As argued in Huang (1982:220), quantifier scope interpretation in Chinese follows the following general condition:

(7) Suppose A and B are both QPs or both Q-NPs or Q-expressions, then if A c-commands B at SS, A also c-commands B at LF

In (6), since the subject noun phrase meige xiaomao "every kitten" c-commands the noun phrase yige hezi "a box", the normal adult reading of (6) is for the subject "every kitten" to have wide scope over "a box"[1].

Since scope interpretation principles may vary from one language to another[2], it is reasonable to assume that such principles as (7) may be a late acquisition triggered by certain salient syntactic properties of the child's native language. If this view is correct, and assuming the young child possesses QR and the conditions on its application as part of his Language Acquisition Device, one will expect young Chinese children not to show a bias in exclusively interpreting the subject NP as having wide scope in (6). A hypothesis about how Chinese children acquire quantificational scope may be the following:

(8) For a sentence of the form [Q-NP_1 V...Q-NP_2..], young Chinese children will not show a bias in interpreting Q-NP_1 as having wide scope over Q-NP_2. Older Chinese children will predominantly interpret Q-NP_1 as having wide scope over Q-NP_2

This paper reports findings from an experiment which tests this hypothesis. 122 Mandarin-speaking children aged between three and eight years old were studied in Beijing, China. With the exception of the eight-year-old group, which consisted of only 13 children, each age was represented by 20 to 24 subjects. To ensure an even distribution of subjects across each age group, each half-age was represented by at least 8 subjects. Due to the relatively small sample size, no attempt was made to control for sex, although as far as possible an equal number of male and female children were sought. In addition, a total of 20 university students and staff aged between 19 and 36 years old were interviewed and asked to complete a questionnaire based on some of the test items administered to the children subjects.

The experiment comprised 20 picture identification tasks (three of which were training tasks) and 11 toy manipulation tasks. Some of these items did not bear directly on quantification and were concerned with other aspects of Chinese syntax[3]. Each child was seen by the same two experimenters, one of whom was the author, for an average of 15 to 25 minutes. The items immediately relevant to our discussion on quantification can be divided into two types. Type I test items explore the child's understanding of the quantificational adverb dou as well as the universal quantifier mei "every" when used in conjunction with dou[4].

(9) [xiongmao] dou shuijiao le
panda all sleep asp./part.
"(The) pandas are all asleep"

(10) [meike tang] dou na chulai
every-CL candy all take out
"Take every candy out"

(9) illustrates a picture identification task in which the child was asked to select from two pictures the one that corresponded to the sentence said by the experimenter (see Figure 1). (10) illustrates an act-out task in which the child

Figure 1

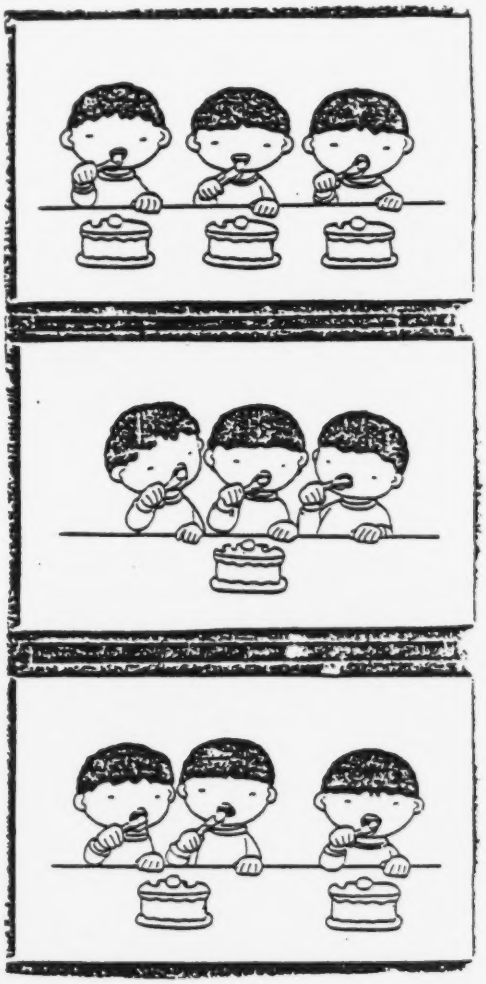

Figure 2

was presented with a set of six candies or marbles and was asked to perform actions according to the test sentence.

Type II test items form the focal part of the study, as they examine the child's interpretation of the scope relations of two quantified NPs. The test sentences are illustrated by (11) and (12). (11) represents a picture-identification task which requires the child to make a choice out of three pictures, while (12) requies manipulation of four toy objects with respect to four empty boxes large enough to hold the entire set of objects (see Figures 2 and 3).

(11) [meige xiaopengyou] dou zai chi [yige dangao]
every-CL child all at eat one-CL cake
"Every child is eating a cake"

(12) [meige taikongren] dou shui zai [yige hezi] li
every-CL spaceman all sleep at one-CL box in
"Every spaceman sleeps in a box"

(13) [meike tang] dou fang zai [yige hezi] li
every-CL candy all put at one-CL box in
"Put every candy in a box"

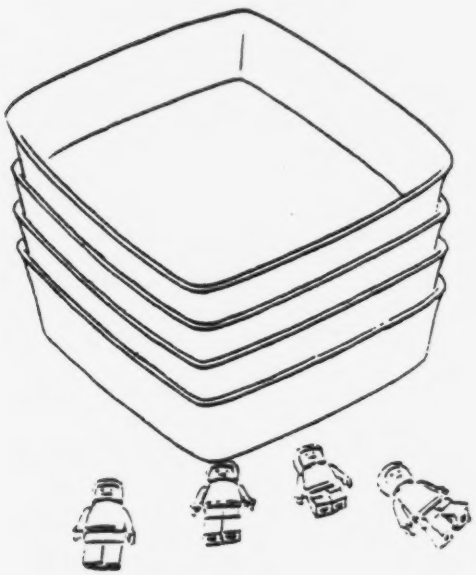

Figure 3

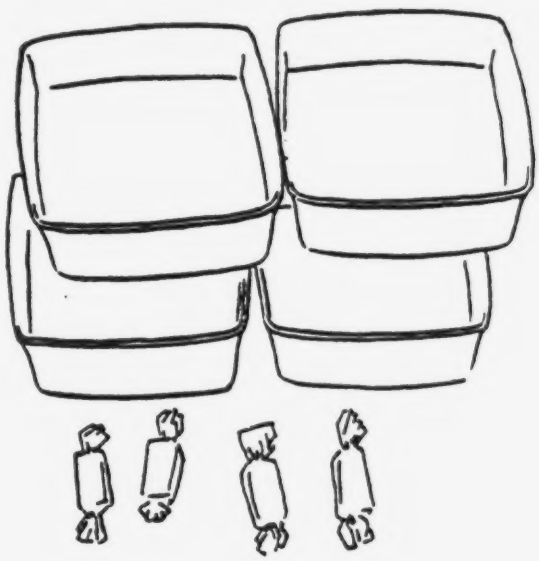

Figure 4

The design of the toy manipulation tasks of (12) was based on one assumption: for tasks such as these, where clearly the spatial arrangement of the toys is likely to affect the child's performance, a more reliable indication of acquisition of adult norms can be obtained only if the spatial arrangement of toys does not facilitate the adult reading. Thus in the test sentence (12), where the adult would normally assign wide scope to the subject NP "every spaceman", the boxes were stacked together in one pile rather than laid out separately (see Figure 3). To examine possible visual effects on the child, test sentence (13) - a task similar to (12)- was included, but in this item the prop configuration favored a wide-scope reading of the subject quantifier, as each of the boxes was in clear view of the child (see Figure 4).

Results

Tables 1 and 2 summarize the results of tasks requiring comprehension of mei and dou. The data clearly show that the meaning of dou as assigning totality of scope to the NP it quantifies is acquired before four years of age.

Table 1. Acquisition of dou in Mandarin
(picture identification)

test sentences: [xiongmao] dou shuijiao le
panda all sleep asp./part.
"(The) pandas have all fallen asleep"
[xiaogou] dou zuo xialai le

doggie all sit down asp./part.
"(The) doggies have all sat down"

Age	No. of Subjects correct on both sentences	No. of Subjects correct on one sentence	No. of Subjects incorrect on both sentences	Total
3 yr	11 (58%)	5 (26%)	3 (16%)	19[5]
4 yr	20 (91%)	1 (4.5%)	1 (4.5%)	22
5 yr	20 (100%)	0	0	20
6 yr	24 (100%)	0	0	24
7 yr	23 (100%)	0	0	23
8 yr	12 (92%)	1 (8%)	0	13

Table 2 Acquisition of mei...dou in Mandarin Chinese (Act-Out)

test sentences: [meige tanqiu] dou na chulai
every-CL marble all take out
"Take every marble out"
[meike tang] dou na chulai
every-CL candy all take out
"Take every candy out"

Age	No. of Subjects correct on both sentences	No. of subjects correct on one sentence	No. of Subjects incorrect on both sentences	Total
3 yr	12 (60%)	0	8 (40%)	20
4 yr	22 (100%)	0	0	22
5 yr	20 (100%)	0	0	20
6 yr	24 (100%)	0	0	24
7 yr	23 (100%)	0	0	23
8 yr	13 (100%)	0	0	13

As regards the act-out task (10), a similar pattern of responses can be observed, pointing to acquisition of adult norms by four. It is worthy of note that as in other test items in the experiment, a higher degree of self-consistency is found in the act-out tasks than in the corresponding picture identification tasks. As Table 2 shows, the children of all age groups either responded correctly on both subtests or gave wrong responses for both sentences.

With regard to the Type II test items, the findings between picture identification and act-out tasks differ considerably. In a test item such as that correspoding to (11), selection of the topmost picture was counted as a wide scope reading of the subject quantifier (see Figure 2), selection of the middle picture was counted as a narrow scope reading, while a choice of the bottommost picture was considered a non-scope reading[6]. As is evident from Table 3, while the adult control group demonstrated a consistent wide scope bias, the child language data do not show at first sight a pattern as clear as those in the preceding tables.

Table 3. Acquisition of mei...yi in Mandarin Chinese (picture identification)

test sentences: [meige xiaopengyou] dou zai chi [yige dangao]
every-CL child all at eat one-CL cake
"Every child is eating a cake"
[meige xiaopengyou] dou zai he [yibei shui]

every-CL child all at drink one-CL water

Age	Subjects with wide scope on both sentences	Subjects with wide scope on one sentence, narrow scope on another	Subjects with narrow scope on both sentences	Subjects with at least one non-scope reading	Total
3 yr	4 (21%)	9 (47%)	1 (5%)	5 (26%)	19
4 yr	2 (9%)	10 (45%)	9 (41%)	1 (6%)	22
5 yr	3 (15%)	3 (15%)	14 (70%)	0	20
6 yr	3 (12.5%)	9 (38%)	12 (50%)	0	24
7 yr	8 (35%)	3 (13%)	12 (52%)	0	23
8 yr	3 (23%)	6 (46%)	4 (31%)	0	13
Adult	16 (80%)	4 (20%)	0	0	20

Despite the apparent irregularity, some revealing tendencies can still be discerned. A first observation that can be made is the high degree of fluctuation between wide and narrow scope readings among the three, four, six and eight-year-olds. In these age groups, between 38% and 47% of the subjects chose a wide scope reading for one test sentence and a narrow scope reading for another test sentence. A second tendency that can be observed is that the number of consistent narrow scope responses increases among the three and four year-olds, followed by a gradual decline after five. A third pattern that should be noted is that a narrow scope bias is seen in all but the youngest age group, and that the ratio of narrow scope readings to wide scope readings gradually decreases with age. The small number of non-scope responses and the complete absence of this type of response after four is also worthy of note.

The above-mentioned patterns are even more clearly manifested in the results of corresponding act-out tasks, given in Table 4 below.

Table 4. Acquisition of mei...yi in Mandarin Chinese (Act out)

test sentences: [meige taikongren] dou shui zai [yige hezi] li
every-CL spaceman all sleep at one-CL box in
"Every spaceman sleeps in a box"
[meige xiaomao] dou zuo zai [yige hezi] li
every-CL kitten all sit at one-CL box in
"Every kitten sits in a box"

Age	Subjects with wide scope on both sentences	Subjects with wide scope on one sentence, narrow scope on another	Subjects with narrow scope on both sentences	Subjects with at least one non-scope reading	Total
3 yr	5 (25%)	1	9 (45%)	5 (25%)	20
4 yr	7 (32%)	0	15 (68%)	0	22
5 yr	6 (30%)	1	13 (65%)	0	20
6 yr	11 (46%)	4	9 (38%)	0	24
7 yr	11 (48%)	3	9 (39%)	0	23
8 yr	8 (62%)	1	4 (31%)	0	13
Adult	19 (95%)		1 (5%)		20

(Note: adult subjects only did one sentence)

In these test items, placement of each object (spaceman or kitten) in a different

box would be considered a wide-scope interpretation, while grouping of all the subjects in one box would be considered a narrow scope reading. If the child, however, placed one or two objects in one box, or placed one or two objects in only two of the boxes each, his response was counted as a non-scope response.

First, it should be mentioned that the subjects showed a very high degree of self-consistency in these two test items. Secondly, a narrow scope bias can be observed among the three, four and five year-olds, while the responses of the six, seven and eight year-olds all clearly indicating a wide scope bias. Here too we see a very small number of non-scope readings and the complete absence of these readings after five. It is worth noting that all the five subjects who gave non-scope responses were those who failed to understand the quantifiers mei "every" and dou "all".

Table 5 gives the results from the prop configuration control item(cf. Figure 4).

Table 5. Acquisition of mei...yi in Mandarin Chinese (Act out, with prop configuration favoring wide scope reading)

test sentence: [meike tang] dou fang zai [yige hezi] li
every-CL candy all put at one-CL box in
"Put every candy in a box"

Age	No. of Subjects with wide scope reading	No. of Subjects with narrow scope reading	No. of Subjects with non-scope reading	Total
3 yr	6 (30%)	9 (45%)	5 (25%)	20
4 yr	9 (41%)	12 (55%)	1 (4%)	22
5 yr	8 (40%)	12 (60%)	0	20
6 yr	17 (71%)	7 (29%)	0	24
7 yr	18 (78%)	5 (22%)	0	23
8 yr	9 (69%)	4 (31%)	0	13

Here, despite a change in prop arrangement, we see similar tendencies: a narrow scope bias among the three, four and five year-olds, a shift toward wide scope bias among the six, seven and eight year-olds, and the disappearance of the non-scope readings after three. A comparison of Tables 4 and 5 reveals that the main difference between the two data sets lies in the subjects giving a slightly higher percentage of wide scope readings in the test item where the prop arrangement favors a wide scope interpretation.

Discussion

The main finding on quantificational scope from this study is that as indicated in the act-out and picture identification items, young Chinese children (three to five year-olds) tend to give a narrow scope interpretation, and a wide scope tendency occurs after five. This result confirms our hypothesis as stated in (8) in that young Chinese children do not follow an isomorphic principle such as (7) in mapping from SS to LF, but instead allow for both wide and narrow scope interpretations of the subject quantifier. One interpretation compatible with the findings is that QR is available to the children very early, so that LF representations assigning both wide and narrow scopes to the subject quantifier can be derived. The data, however, is also consistent with the hypothesis that the child showing a narrow scope interpretation is actually interpreting indefinite singular noun phrases such as yige dangao "a cake" referentially. In this latter view, the child selects the value for the variable bound by the existential quantifier independently of the value chosen for the variable bound

by the universal quantifier. It is only at a later stage the child learns that a numeral phrase such as "a cake" can be interpreted non-referentially under the influence of universal quantifiers.

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Notes

[1]The fact that in (6) "every kitten" has scope over "a box" does not mean that one cannot have a narrow scope reading of "every kitten", as the latter interpretation is also consistent with the logical representation of the former, i.e. in the logical representation "for every x=kitten, there exists y=box such that x is sitting in y", the y may happen to be identical for every kitten, and this would be tantamount to a narrow scope reading of the subject. Thus, consistent with the possibilities permitted by the logical representation, Chinese adults could give the latter reading, albeit an extremely weak one. This is borne out by the results in Table 3.

[2]Gil (1982) reports that in languages such as Batak and Tagalog, it is the patient NP that tends to have wide scope. Munro (1984) also shows that in Pima, it is the direct object or prepositional object that takes wide scope over other NPs in the sentence.

[3]These tasks are related to the child's grasp of topic structures and scope relations involving modals and negation.

[4]It is not possible to test the child's understanding of mei alone in sentences of this form, because the occurrence of mei in preverbal position is sanctioned by the presence of dou.

[5]It was decided that the picture identification results of one of the three-year olds should be rejected because of extremely low self-consistency on picture-identification items, although her peformance on act-out tasks was on the whole fairly consistent.

[6]The reading represented by the bottommost picture in Figure 2 corresponds to an incomplete group reading in which each member of the set of pandas bears the predicate relation to at least one member of the set of cakes. For convenience, this choice will be referred to as a non-scope reading.

References

Huang, J. (1982) Logical Relations in Chinese and the Theory of Grammar. MIT doctoral dissertation.

Gil, D. (1982) "Quantifier Scope, Linguistic Variation, and Natural Language Semantics," Linguistics and Philosophy 5: 421-472.

Hyams, N. (1984) UCLA colloquium lecture.

Li,C. and S. Thompson (1981) Mandarin Chinese: a functional reference grammar. Los Angeles: University of California Press.

May, R. (1977) The Grammar of Quantification. MIT doctoral dissertation.

Munro, P. (1984) "Floating Quantifiers in Pima" in Syntax and Semantics 16 New York: Academic Press.

PPCLD 25
1986

The assignment of sentence accent and contrastive stress by two 28-month-old twins

Claudia A. Mazzie
University of Pennsylvania[1]

Although we know a great deal about how the young language learner progresses from single words to more complex syntax, we understand relatively little about the child's development of intonation--particularly after the one-word stage. From a look at the literature, it seems that, as soon as children produce anything approaching a recognizable syntactic structure, all interest in intonation is abandoned--except, of course, as a means for establishing "utterance boundaries." But more recently, thanks to the blossoming study of developing communicative competence, we are now learning much more about young children's use of prosody on the pragmatic level. Here, the focus has been on the learner's ability to use prosodic means to mark the informational structure of a discourse. Specifically, what is examined is the systematic placement of "contrastive stress" (also known as "heavy stress," "emphatic stress" and "tonicity") with regard to the distinction between "old" and "new" (or given/new, topic/comment) elements comprising an utterance.(2) In spoken English,the most common way of signalling this distinction is by endowing the new information with greater acoustical prominence, making the most informative part of the utterance the most salient by placing it in the perceptual foreground of the listener's attention.

From the literature it would appear that English-speaking children learn this connection between the prosodic and the pragmatic system very early; children as young as 33 months--it is claimed--consistently use emphatic stress to mark new information in a pragmatically appropriate way.

But unfortunately, most every study investigating stress placement by young children suffers from two important limitations:

In the first place, almost all of these studies rely upon experimentally-elicited speech, using picture description tasks to evaluate children's competence. But the ability these experimenters are trying to tap--children's adult-like marking of the old/new information distinction--is inherently part of connected, INTERACTIVE discourse.

The second problem is a descriptive one: perhaps because of the pervasiveness of the vague term "contrastive stress," these studies confuse making a contrast with the addition of new information. Although they set out to test children's ability to prosodically mark informational distinctions, these researchers use experimental tasks which instead involve the use of stress to mark CONTRAST.

This distinction, though generally blurred, is real and especially important in terms of acquisition. Adding new information to a discourse and making a contrast with a previous proposition differ on many counts, even though the means of marking them--in English--are similar. For one thing, a contrastive item, though stressed, need not be new information. In addition, making a contrast involves preserving the syntactic frame of the sentence that's being contested; the stressed items are substituted into slots forged by the preceeding utterance. But the process of adding new information to a discourse topic is not structurally constrained in this way; mention of the entitiy being "talked about" is simply maintained, and a new predication is made about it.

So, in light of the limitations of previous research--the confusion of contrast and new information marking, and the questionable validity of non-naturalistic testing of a

discourse phenomenon--the only thing we may conclude with any certainty is that, within an experimental context, children are able to use prosody to mark contrast. Whether young children can use stress to indicate the old/new information distinction remains unknown.

Thus the goal of the present study was to overcome these limitations and ask: Do young children use sentence accent (a less ambiguous term than stress) to mark new information as systematically as they have been shown to handle contrastive stress--within the course of NATURALLY-OCCURING discourse?

The main hypothesis of this study was that children would use stress to mark contrast more consistently, in a pragmatically appropriate way, than they would new information. Contrastive stress would seem, in some sense, "simpler" to apply--you just borrow the frame of the previous utterance and add a little physiological pressure to the item you substitute. In contrast, distinguishing new information from old and marking it appropriately would require the child to have a tacit understanding of the discourse structure; this, in turn, entails the ability to recognize the discourse topic and, at a higher level, to model the interlocuter's knowledge base.

To test this hypothesis, I examined the speech of two 28-month-old twins, a boy and a girl, children of a white middle class couple. The data were gathered naturalistically, in three one-hour sessions, in the children's home, where the spontaneous conversation of the twins with several adults was recorded.

I will describe the coding of the twins' speech in some detail because, clearly, one of the major challenges in studying pragmatic/discourse phenomena is formulating well-defined and valid categories with which to analyze the data.

First, for each of the twins' utterances, the word judged perceptually as bearing more acoustic prominence than any other was coded as stressed. (Inter-coder reliability = 96.6%) Perceptual judgement is the conventional means used to code stress; and, in fact, in the case of the present speech samples, stressed items were,in most cases, extremely more prominent than non-stressed items.

Not all of the utterances, however, could be included in the final analysis.

Unintelligible, interrupted and yes/no responses were excluded for obvious reasons; yes/no questions were not included becuase they conventionally have a gradually rising intonation, with no single element singled out for stress; for " elliptical" utterances--those lacking old information --there was no way to determine whether the new item was stressed because it was new, or because it was the only content ("open class") item in the utterance.

The percentage of utterances which had to be excluded from the analysis was the same for both twins--55.7%. From twin 1's speech,363 utterances were used (44.3%), and 255 from twin 2 (also 44.3% of the corpus).

These remaining utterances were coded for a number of features. Here, it would be most appropriate to explain the criteria used to classify tokens along the most crucial dimensions: Comment, contrast and misfire.(3)

An utterance was classified as COMMENT if the lexical item stressed was a comment not previously expressed by any of the interlocuters made upon a topic which had already been introduced into the discourse, and mentioned in at least one of the immediately preceding 10 turns at talk. If the topic was mentioned in the utterance immediately preceding the utterance being coded, but by a different speaker, it was coded as OTHER-COMMENT; if the topic was not included in another speaker's preceding utterance, but in the preceding turn of the same speaker--the child--the utterance was coded as SELF-COMMENT.(4)

Two examples of OTHER-COMMENT are shown in example 1 below.(5)

(1) T1>B: i saw the BALL/

B>T1: you saw the ball?/

T1>B: the tiny little RED one/

B>T1: ohh, a ball off my purse?/

T1>B: it DROPPED/

An utterance was coded as a COMMENT-MISFIRE if it included a word which was a COMMENT according to the criteria given above, but was not the word which received the sentence accent. Please see example 2.

(2) T1> R: i want my HAT/
i want my HAT/

R>T1: oh, where's your hat?/

T2> R: it's on (.) the: sta- /

T1> R: -i'm gonna go-go FIND my-
i'm gonna go find my HAT/

An utterance was considered an instance of CONTRAST if it was structurally almost identical to a preceding utterance (within 10 turns of talk), except for a substituted lexical item which received contrastive stress. If the utterance upon which the token being coded was produced by the same speaker--the child, that is, it was coded as SELF-CONTRAST; if the model utterance was produced by a different speaker, it was coded as OTHER contrast. Number 3 below gives an example of OTHER contrast:

(3) T1> R: i'm gonna build them ON the black thing/ [=blocks]

R> T1: how 'bout if you build it on the wastepaper basket?/

T1> R: i'm gonna build it on the TABLETOP/

An utterance was coded as CONTRAST-MISFIRE if it satisfied the structural criteria given for CONTRAST, but included stress which was placed on an item other than the substituted word. Please see example 4.

(4) B> T2: what do you have on?/
what color do you have on, C----?/

T2> B: i have a blue shirt TOO/

B> T2: but you don't have it on/

T2> B: but i have-on my-i have a blu:e shi:rt too:/

B> T2: uhmmm, you have a blue shirt/

T1> B: i have a blue SHIRT/

RESULTS

Table 1 gives a general breakdown of the number and proportion of utterance types found in the speech sample of each twin; as can be seen, the distributions are amazingly similar across the two children. The largest percentage of

utterances fell into the COMMENT category, with the proportion of OTHER COMMENT twice as high as SELF COMMENT for both children; this pattern is repeated in the CONTRAST category. However, both of the young speakers repeated their own utterances more often than others' speech.

TABLE 1: Distribution of Utterance Types

UTTERANCE TYPE	TWIN 1	TWIN 2
Topic-initiating	17.8% (65/363)	18% (46/255)
Repetition---Self	20.1% (73/363)	12.2% (31/255)
Other	2.6% (10/363)	10.6% (27/255)
Comment------Self	9.7% (35/363)	6.7% (17/255)
Other	19.3% (70/363)	27.5% (70/255)
Contrast-----Self	5.2% (19/363)	2% (5/255)
Other	13.2% (48/363)	16.9% (43/255)
Misfire--Comment	4.7% (17/363)	3.5% (9/255)
Misfire--Contrast	1.9% (7/363)	2% (5/255)
	n = 363	n = 255

Turning now to our major hypothesis, we can see from the figures on Table 1 that the proportion of MISFIRE--that is, the misapplication of sentence accent or contrastive stress--in the children's speech is quite small; in each case the percentage of mistakes is less than 5% of the total corpus; and combined, the errors comprise less than 7% of the total. As early as 28 months, then, these children appear to be quite competent at assigning sentence accent and contrastive stress in a pragmatically appropriate way.

In order to compare the percentage of errors between categories, the ratio of misfire to total number of utterances within a given category was calculated, and is presented in Table 2:

TABLE 2: Misfire within Category

MISFIRE TYPE	TWIN 1	TWIN 2
Misfire-Comment/Tot.Comment	17/122 (13.9%)	9/96 (9.4%)
Misfire-Contrast/Tot. Contrast	7/74 (9.5%)	5/53 (9.4%)

Although TWIN 1 has a higher percentage of misfire-comment tokens, for neither twin is there a significant difference between the two misfire types. This result disconfirms the original hypothesis: these children apply sentence accent to mark new information equally consistently as they use contrastive stress. Overall, they used prosodic marking appropriately for BOTH functions in well over three-fourths of the instances where they used stress at all.

Now, we might predict that prosodic "misfires" would be made more often when the children were commenting upon another speaker's topic or making a contrast with another's utterance. As the figures on Table 3 indicate, however, this is true for only one of the twins; for the other, more mistakes occured in SELF-COMMENT and SELF-CONTRAST tokens:

TABLE 3: Misfire--Self vs. Other

MISFIRE TYPE	TWIN 1	TWIN 2
Misfire-self/Total Misfire	20/24 (83.3%)	5/14 (35.7%)
Misfire-other/Total Misfire	4/24 (16.7%)	9/14 (64.5%)
	n = 24	n = 14

Since we've found that both twins marked new information consistently, we might ask whether they regularly marked old information as well, with the use of discourse anaphoric pro-forms. Table 4 shows the number of SELF-, OTHER-, and MISFIRE-COMMENT tokens which contained an anaphoric form:

TABLE 4: Tokens Containing Anaphoric Forms

	TWIN 1	TWIN 2
Other-Comment	64.3% (45/70)	62.9% (44/70)
Self-Comment	60.0% (21/35)	64.7% (11/17)
Total Comment	62.9% (66/105)	63.2% (55/87)
Misfire Comment	22% (2/17)	0 (0/9)

For both children, in two-thirds of the utterances in which sentence accent was correctly assigned to the "new" element, the old information was conveyed by an anaphoric form. This suggests that these children are able to mark the "old-new" distinctions using a variety of linguistic devices. Significantly, when the twins assigned sentence accent incorrectly, they were much less likely to use an anaphoric form, indicating that perhaps some kind of co-occurence restriction is in force.

If we examine utterances which lacked old information--those which introduced a discourse topic--we can discover the distribution of stress placement when the "old-new" constraint is lifted. In the speech of both of the twins, objects and "other" (most of them predicate nominatives) were favored for stress placement, while subjects and prepositions were clearly disfavored; the only comparison we can make here with adult norms involves the incidence of stress on the last lexical item in an "all-new" utterance. According to Ladd (1979), who is concerned with adult speakers of English, in the unmarked or neutral case--where the whole intonation-group is considered "new"--stress typically occurs on the last lexical item in the intonation-group.

In the twins' speech,though, this neutral pattern of stress placement described above is not used consistently to introduce all-new utterances into the discourse. As you can see from the figures in the first row of Table 5, for one

child, two-thirds of the topic-initiating utterances contained a final accented lexical item; this was true only half the time for the other twin. It appears, then, that at this age these children are better skilled in the use of sentence accent to mark new information, and less adept in the placement of accent in the neutral case, where all the information contained in an utterance is new.

Perhaps one reason for this marked accent placement in topic-initiating utterances is that the children themselves do not interpret these utterances as "all-new." This possibility is indicated by the children's inappropriate use of pronouns to introduce new entities into the discourse (excluding the deictic use of such forms which can be, of course, appropriate):

TABLE 5: Topic-initiating Utterances

Type of T.I. utterance/ Total	TWIN 1	TWIN 2
Last Item Stressed/ Total T.I.	31/65 (47.4%)	29/46 (63%)
Inappropriate Pronoun/ Total T.I.	10/65 (15.4%)	6/46 (13%)
Non-final Stress/ Total T.I. + Pronoun	8/10 (80%)	5/6 (83.3%)

As you can see in the last two rows in table 5, pronouns were inappropriately used in less than one-fifth of the twins' topic-initiating utterances; but when then did occur, the accent was seldom placed on the last lexical item. This pattern may indicate that in these utterances the children were making an "old-new" distinction even though the "old" enitity had not been mentioned in the immediately preceeding talk.

DISCUSSION

Based on the speech samples analyzed here, we can say with some certainty that, by the age of 28 months, these two children have made an important connection between two components of their developing linguistic competence--their prosodic system and their pragmatic system. The twins used sentence accent to mark the distinction between old and new information in an appropriate way better than 85% of the time; and they employed contrastive stress in more than 90% of the utterances which called for its use. It is reasonable to claim that these twins have attained almost complete mastery over this aspect of their prosodic system.

Finally, I'd like to offer more convincing evidence, which comes from the children themselves in the form of self-corrections. Several times during the recording, the twins corrected their placement of sentence accent and contrastive stress. Examples 6-8 were taken from the transcript:

(6) T1> R: can I put fire on your buns?/
can I?/
can I?/

R > T1: I thought you already did/

T1> R: no I DIDNT/

R > T1: oh well, then, don't/

T1> R: **well I'm gonna-i'm GOING to put fire-**
I'm GOING to put fire on your buns/

(7) T1> R: when YOU have fire in mouth/
YOU cry for your mom an' daddy/
R> T1: yeah proababy/

T1> R: **when claudia--when cl-CLAUDIA got fire in HER mouth/**
she cry for HER mom an' daddy/

(8) T1> R: do you have some footies (.) at home?/
R > T1: yeah/
at home I have
some footies/
do you have some
footies?/
(.5)
no?/

T2> R: I do/

R> T2: you do?/

T2> R: hunh/
in MY-in my SHOES/

It would be hard to imagine why these children corrected their prosody in this way unless we attribute to them a tacit knowledge of the "rules" governing sentence accent and contrastive stress placement.

How might these rules be learned by young children? And learned they must be, for the way in which a language's suprasegmental system is integrated with its segmental patterning is language specific, even in the use of sentence accent to mark focus or new information. Because this method of distinguishing topic from comment is clearly **not** universal (in Russian, for example, the comment is signalled by a drop in pitch), it must be learned. But how?

Part of the answer might lie in the nature of the learner's verbal input. Almost every description of caregiver speech to infants includes the observation of exaggerated intonation and/or unusual prosodic features, but only for English have these suprasegmental peculiarities been analyzed. Fernald & Mazzie (1983) found that white-middle class mothers, when talking to their 14-month old infants, consistently placed unusually high pitch peaks on the new information contained in an utterance. Given infants' perceptual bias toward high pitch (Fernald, 1985), it is likely that they do attend to this acoustical-highlighting pattern. For children of English-speaking caregivers who indulge in motherese, this means heavy exposure--begun early--to this prosodic/pragmatic regularity in their target language; such early and prolonged "training" might account--in part--for the precocious acquisition of the complex co-ordination of prosody and pragmatics we have documented here.

NOTES

1. I would like to thank Julie Roberts, Thomas Steele, and in particular, Bambi Schieffelin for their help and support.

2. The relevant studies are included in the references below.

3. The taxonomy of given and new information presented in Prince, 1981 distinguishes between "inferrable" and "situaationally evoked" entities; although the entities mentioned in a discourse which fall into these categories pattern in some ways like "old" information (e.g. they typically take definite articles), with regard to sentence -accent placement they behave like "new" entities. This strange distribution has scarcely been noticed, but see Brown, 1983 which shows that "inferrable" entities do receive accent.

4. Clearly an instance of OTHER COMMENT could be a SELF COMMENT as well; the classification here was made (artificially) exclusive, since it is probably impossible to determine whether a child intends his utterance as a comment upon his own or his interlocuter's previous utterance. If such a distinction could be reliably made--perhaps using video data--it would be extrodinarily helpful in establishing whether the children are making the old-new contrast with regard to their listener's knowledge base--an issue that has not been considered here.

5. Transciption conventions are as follows:
   1) The twins' utterances are given in the left column; the adults' are on the right.
   2) A lexical item in all-caps denotes the stressed word.
   3) Lengthening has not been noted.
   4) T1 = Twin 1, male T2 = Twin 2, female
      R = Experimenter B = the twins' babysitter (an adult female)

REFERENCES

Baltaxe, Christine E. (1984) Use of contrastive stress in normal, aphasic and autistic children. Journal of Speech & Hearing Research, 27: 97-105.

Brown, G. (1983) Prosodic structure and the given/new distinction. In: A. Cutler & D.R. Ladd, (eds.) Prosody: Models & Measurements. Berlin: Springer-Verlag.

Fernald, A. (1985) The perceptual and affective salience of mothers' speech to children. In: L. Feagans, C. Garvey & R. Golnikoff (eds.) The Origins and Growth of Communication. Norwood, NJ: ABlex.

Fernald, A. & Mazzie, C. (1983) Pitch marking of new and old information in mothers' speech. Paper presented to the SRCD.

Hornby, P.A. (1971) Surface struture and the topic-comment distincion: a developmental study. Child Development, 42: 1975-88.

Hornby, P.A. & Hass, W.A. (1970) Use of contrastive stress by preschool children. Journal of Speech & Hearing Research, 13: 395-99.

Ladd, D.R. (1979) Light and shadow: a study in the syntax and semantics of sentence accent in American English. In: L.R. Waugh & F. van Coetsem (eds.) Contributions to grammatical studies: semantics and syntax. Leiden: Brill.

MacWhinney, B. & Bates, E. (1978) Sentential devices for conveying givennes and newness: a cross-cultural developmental study. Journal of Verbal Learning and Behavior, 17: 539-558.

Prince, E.F. (1981) Toward a taxonomy of given/new information. In: P. Cole (ed.) Radical Pragmatics. NY: Academic Press.

Wieman, L.A. (1976) Stress patterns of early child language. Journal of Child Language, 3: 283-286.

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DISTINGUISHING EFFECTS OF PARAMETERS IN EARLY SYNTAX ACQUISITION: A CROSS-LINGUISTIC STUDY OF JAPANESE AND ENGLISH

Reiko Mazuka, Barbara Lust, Tatsuko Wakayama & Wendy Snyder
Cornell University

I. INTRODUCTION

Current linguistic theory is critically concerned with the discovery of 'parameters'. This is in accord with the general project of Universal Grammar (UG) articulated by Chomsky (e.g. 1981,4). Parameters specify which dimensions languages in principle may differ along, and what the possible variations may be. According to the parameter-setting approach of UG, the child is biologically programmed to attend to specific types of possible language variation and sets the value of such parameters very early, with only limited experience. Widely different aspects of grammar acquisition can be deduced at once from this parameter setting. Thus, parameter-setting can significantly help to explain how successful acquisition of widely varying languages is achieved within roughly similar time-spans, e.g. English, Japanese, Hindi, etc.

We will assume that if the general theory of UG and the parameter-setting approach is correct, then the valid parameters will have empirical consequences in first language acquisition.

II. PREFERENTIAL SUBJECT OMISSION

Recently it has been argued that early stages of English syntax acquisition do reflect the effects of parameter-setting. Some of these arguments concern a phenomenon which we shall term "preferential subject omission"(PSO henceforth). This phenomenon is exemplified by sentences like "Count buttons" meaning "I", "you" or "he" counts buttons, where the subject of a tensed sentence is null, but has definite reference. The major arguments that PSO characterizes early stages of first language acquisition of English involve: 1) "predicate constructions with subjects not expressed ... predominate" at ages up to about 2;9 (Menyuk, 1969); 2) "... the first English 'sentence' consists of a predicate phrase with an optional subject" (Braine, 1976, ages 24-28 mos.); 3) While "the most productive category 'construction' was VO (verb object), the "least productive ... was SV (subject verb)" (Bloom, 1970, 131, 167, ages 19-27 mos).

III. PRO-DROP PARAMETER AND PREFERENTIAL SUBJECT OMISSION

Hyams (1983) has argued that this phenomenon of PSO in children's early English speech reflects the unmarked setting of a version of a binary 'pro-drop' parameter.

III.1 Pro-drop parameter

Languages like Spanish and Italian among others allow null subjects with pronominal interpretations in tensed clauses. These are

often called "pro-drop languages." For example, while the Italian sentence (1) is grammatical where the null subject has a definite referent, such a sentence in English is ungrammatical as in (2). Several other grammatical variations are argued to correlate with this parameter-setting.

(1) Ø Magia come una bestia.
(2)* Ø Eats like a beast.

Several alternative formulations of this parameter are currently being argued on linguistic grounds (see Van Riemsdijk and Williams, 1986 for review).

III.2 Hyams' proposal

According to Hyams, [+pro-drop] is the unmarked setting of this parameter. As one consequence of this parameter-setting, that children in all languages hypothesize that subjects with definite reference can be optionally omitted in tensed clauses. Thus, Hyams proposes that children initially hold a false hypothesis in a language like English, which is [-pro-drop].

If this theory were correct, PSO in early acquisition of English is, thus, not due to a performance constraint on length or complexity but to this incorrect parameter-setting. Also if this theory is correct, then PSO will occur in early stages of acquisition of all languages. In addition, lexical expletives like pleonastic "it" and existential "there" in English will be absent during the same period. If the grammar allows a null subject, there is no need for a lexical element that does not have semantic content, assuming a universal "Avoid Pronoun Principle." Hyams proposes that the child's noticing the existence of these expletive elements in English eventually triggers English speaking children to restructure their initial grammar by resetting the 'pro-drop' parameter.

III.3 Critique of pro-drop proposal

The Hyams proposal is an interesting and significant one whose specific predictions for acquisition deserve to be experimentally tested.

Initially, the Hyams proposal raises a number of significant issues. These concern (1) the theoretical coherence and validity of the pro-drop parameter (e.g. Huang, 1986); (2) the theoretical coherence of the proposal for explaining first language acquisition. (For example, if the child acquiring English initially filters out data because of a false hypothesis, how and why does it eventually process such "expletive it" data in order to cause restructuring?); (3) empirical issues regarding the description of and explanation of acquisition facts, e.g. PSO. (4) A critical test of this proposal for the "pro-drop parameter" must involve a test of its universality cross-linguistically. It must also involve test of proposed wide deductive consequences of the parameter, and the coherence of a wide set of acquisition facts related to these consequences. We treat these issues more fully elsewhere but raise here a selection of issues and pertinent arguments relevant to (3) and (4).

Our initial results suggest that the pro-drop parameter may not uniquely explain PSO in English acquisition. In addition, initial

cross-linguistic study (Japanese-English) suggests that PSO may not be a universal phenomenon in first language acquisition. Therefore, PSO data in first language acquisition in English do not provide critical evidence for the hypothesis that [+pro-drop] is the universal parameter-setting in early first language acquisition. Finally, we suggest a possible alternative explanation for the PSO phenomenon and related acquisition facts within the parameter-setting framework.

III.3.1 Explanation of English PSO

Several aspects of English acquisition suggest PSO is not a simple result of a child's hypothesis about subject argument optionality. Arguments in support of this conclusion include the following. (1) PSO is linked to the amount of complexity in an utterance. For example the subject is more often expressed when utterance complexity is reduced by absence of explicit verbs in children's early utterances. Thus noun-noun compounds, such as "Gia eyes" (interpreted as "Gia has eyes", Bloom, 1970, P.85) are found in children's speech by Bloom (1970) and others.

(ii) Also, children express subjects more often when the verb is intransitive rather than transitive. With intransitive verbs, utterance complexity need not be increased by an additional argument, as it must with transitive verbs. This is exemplified in the contrast in (3) below.

(3)	Vt-Oj	Sj-Vi
Jonathan II (2;0)	Eat dessert.	Mommy sit.
	Bounce ball.	Andrew walk.
	Bite block.	Daddy sleep. (Braine, 1976)

(iii) Furthermore, as Bloom has argued, when the child acquiring English does add a subject to its utterance, these sentences are often in general simpler, in that they do not evidence the extra phrasal complexity which can be seen in utterances where the subject is omitted. See for example such contrasts between utterances with and without subjects in (4).

(4).1. Kathryn II (22.5mo MLU 1.92)

make more under bridge.	Lois make a car.
make car under bridge.	Kathryn make a house.

2. Kathryn I (21mo, MLU 1.32)

no pocket in there.	Baby cottage cheese. (Bloom, 1970)

(iv) Omission of arguments other than subjects also occurs at this stage. For example, Bowerman (1973) reported Kendall's (23mos) utterances such as "Daddy hide Ø", and "Kimmy bite Ø " where object noun appears to be omitted. Verbs are omitted, eg in N-N compounds noted above. These omissions and others cannot be explained by the pro-drop parameter as currently formulated.

(v) Finally subjects at this stage are often reduced to schwa, as in " find it", " play it" (Eric II, Bloom,1970, 111). This seems to suggest that children at this stage are aware that subjects should be expressed, although they are constrained to simplify. If the subject is hypothesized to be optional, there would appear to be no

need for a child to express it with such a reduced form.

These data taken together would suggest that PSO occurs as a partial function of a constraint on composition of complexity within the production of a single utterance at early stages of acquisition (cf. Bloom, 1970, for an initial formulation of such a constraint). Presumably this constraint is a 'performance' constraint on output, not a grammatical one[1].

Given the above argument, it would still remain possible that children acquiring English do hypothesize that subject omission is grammatically licensed by their [+pro-drop] parameter-setting. Subjects appear in fact to be more frequently reduced than other arguments or constituents. However, the argument above show that the PSO phenomenon in English itself seems to be explained at least in part by more general performance factors. Therefore, English PSO data cannot be taken alone to critically confirm the [+pro-drop] parameter- setting.

III.3.2 Test of universality of the [+pro-drop] parameter setting

To begin to test whether PSO is universal in early stages of language acquisition, we have compared Japanese first language acquisition for evidence of PSO with regard to the arguments in II above.

Japanese is an SOV, left branching language. Adult Japanese freely allows subject omission as well as other argument omission as (5) below exemplifies:

(5)	English	Japanese
	Tom saw Bill.	Tom ga Bill o mita.
		-nom -acc saw
*	Ø saw Bill.	Ø Bill o mita.
*	Tom saw Ø.	Tom ga Ø mita.
*	Ø saw Ø.	Ø Ø mita.

Japanese thus could very naturally show preferential subject omission in early acquisition.

We have initiated a study of the natural speech of three young Japanese children from the Tokyo area (MY, HH, KY in Table 1). They were aged 2;1-2;5, and appeared to be at early stages of language acquisition (before emergence of recursive complex sentence structures and with an ostensible length constraint). In addition, we analyzed one published corpus from a young Japanese child (named SN in Table 1) aged 1.6 to 1.9 (studied by Noji, 1979).

Our initial results from these analyses of Japanese acquisition are summarized in Table 1. The left half of the table shows the frequency of different word combination types and the right half of the table shows examples of each word combination type. All word combinations in the 4 samples were extracted and categorized into subject-predicate constructions and non-subject-predicate constructions as the table indicates. Our analysis is mainly based on the

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[1] Hyams argues against Bloom's linking of PSO to performance constraints (Hyams, 1983, p. 223, note 8). However, our arguments (i)-(v) are independent of Hyams' remarks on this issue.

Table 1. Frequency of Early Word Combination Type in Young Jpanese Children's Natural Speech.

word comb. type	Child age	MY (2;1)	HH (2;3)	KY (2;5)	SN (1;6-1;9)	total	Example of utterences
1) N_1(Sj) - N_2 (N_1=N_2)		3	11	8	1	23	Kore ohimesama. (MY) this princess "This is a princess"
2) N_1(Sj) - N_2 (N_1≠N_2)		1	4	20	3	28	Boku wa waagen. (KY) I -top wagon "I (will take) the wagon"
3) N(Sj) - Vi		0	0	4	20(3)[1]	24	Waagen aru (KY) wagon exits "There is a wagon"
4) N(Sj) - Vt		0	2(2)	2	0	4	Mama ga yaita no (KY) Mommy-nom baked "Mother baked (it)"
5) N(Sj) - Aj		0	2	8	3	13	Nyan ga warui no. (KY) cat bad "The cat is bad"
Subject - Predicate construction total						(92)	
6) N(Oj) - suru[2]		0	2	2	17	21	Nenne siteru (HH) sleeping is doing "(someone) is doing sleeping"
7) N(Oj) - Vt		1	6(2)	2	11(5)	20	Ouchi o kaita no (HH) house-acc drew "(I) drew a house"
8) N(Loc) - Vi		0	0	3	22	25	Attchi itta (SN) that way went "(something) went that way"
9) N(non Sj)-N		0	0	5	3	8	Buuwa takitaki. (SN) fire burn "Burn fire"
10) Ad - Vi		1	0	1	0	2	Kooshite shinjatta. (MY) like this have died "(It) has died like this"
11) Ad - Vt		0	0	2	0	2	Akaruku suru no.(KY) bright make "(I) make (something) bright"
12) Ad - Aj		0	4	1	0	5	Moo ii. (HH) already good "(It's) enough"
Non Subject - Predicate construction total						(83)	
other 2 word comb.		0	3	31	4	38	
more than 2 words		0	7(1)	7	9	23	
total word comb.		6	41	96	93	236	
total # ot utt.		85	120	156	551	912	

N=noun, N(Sj)=subject noun, N(Oj)=object noun, N(Loc)=locative noun, Vt=transitive verb, Vi=intransitive verb, Aj=adjective, Ad=adverb, Qt=quantifier

1. Japanese request forms optionally take an overt lexical subject Thus, they are included in the table. the number of request forms in each of the word combination types are in parentheses.

2. By using a noun which indicate an action, as shown in 6) above, "Np o suru" forms a complex verb in Japanese. This structure is particularly productive in children's speech.

predominant 2-word combinations[2].

Our results include the following four:

(i) Lexical subjects are productive in these early stages of Japanese. Table 1 shows that there were 92 subject-predicate constructions as opposed to 83 non-subject-predicate constructions among the 2 word combinations. For example, Noun-Noun constructions, such as, example 1, "Kore wa chimesama" ('This is a princess'), are one of the most productive constructions in these Japanese acquisition data.

(ii) Table 1 also shows that the subject-verb structure, such as example 3, "Waagen aru" (There is a wagon) is observed relatively frequently. This is in contrast to English early natural speech where Subject-verb combinations were reported to be the least frequent.

(iii) Predicative object-verb constructions, such as example 7 on the table, "Ouchi o kaita no" (Drew a house), are not the single most productive construction in the corpuses, as they were reported to be in English.

(iv) Not only are subjects omitted, but other arguments are also. This can be seen in the example (6) below:

(6) KY (2;5) **Pan o mama ga tsukuru no ?**
bread-acc mommy-nom make
"Is mommy gonna make bread?"
Mama ga ∅ yaita no.
mommy-nom baked
"Mommy baked (bread)"

Here, after uttering the full SOV sentence, the child retained the subject and uttered a sentence omitting the object.

In summary, then, (i)-(iv) show that these Japanese early acquisition data do not mirror the full pattern of English acquisition data with regard to PSO (cf. section II above). If PSO as in English acquisition is necessary consequence of a child's hypothesis of a [+pro-drop] parametersetting, then these Japanese results would suggest that this hypothesis is not universal.

IV. ALTERNATIVE EXPLANATION FOR PSO PHENOMENON

There have been other approaches to the explanation of the PSO in acquisition.[3] We consider one of them here.

IV.1 Principal Branching Direction parameter approach

Elsewhere, it has been recently argued that the PSO in early acquisition can be explained in terms of another parameter, one that has been termed "principal branching direction" (PBD) or "canonical

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[2] In the analysis of data, we, like all previous studies of natural speech, adopted the "rich interpretation" method (Bloom et al, 1980). That is, we interpreted children's intended utterance meaning on the basis of context and situation.

[3] For example, Guilfoyle, 1984.

branching direction" (e.g. Lust, 1986, Lust & Chien, 1984). This parameter is related to but not identical to the "Head Direction" parameter proposed by Chomsky (1982). It establishes basic configurational properties of a language.

Under this proposal, the child acquiring English has set the PBD parameter rightward, thus establishing that English generates sentence complexity productively and recursively rightward. When under a general length/complexity constraint at early stages, the child is forced to reduce its output in production. Under this performance constraint, it produces partial utterances. These utterances may include predicative structures because they are frequently rightward in the sentence and thus correlate with the general right branching (RB) setting of the PBD parameter for this language. Omission of subject is thus not a direct result of a hypothesis about empty category grammatical subject. It is an adventitious result of the interaction of a parameter involving the grammar of complex sentence formation with performance constraints. It follows indirectly from an interaction of rightward parameter-setting of a parameter which is related to configuration with general performance constraints which restrict how much complexity a child can actually express in an utterance.

Several arguments support this proposal.

(i) If the above explanation is correct, then PSO should be at least partially linked to performance factors. English first language acquisition data seem to support this hypothesis, as discussed above (III.3.1).

(ii) If PSO in early English acquisition is due to an unmarked [+pro-drop] parameter setting, then it should occur universally (Hyams, 1983). However, if PSO is significantly linked to a configurational parameter like PBD, then it should occur in RB but not in LB languages. This is because only a RB setting of this parameter determines recursive rightward productivity of sentence formation. In support of this hypothesis, we note occurrence and non-occurrence of PSO in English and Japanese (RB and LB respectively) (III.3.2).

(iii) In the acquisition of RB and LB languages, if presence or absence of PSO correlates with presence or absence of other syntactic consequences which appear to be related to the PBD parameter, then this will strongly suggest that the PSO phenomenon is, like these other acquisition facts, determined by the configurational branching direction (or related) parameter. It will also suggest that PSO is linked to more general aspects of sentence construction. We consider this hypothesis in IV.2 below.

IV.2 Related syntactic Facts in Acquisition

In English acquisition, PSO coheres with a wide set of other facts which appear to be linked to the branching direction of the English language, and which appear to be unrelated to the pro-drop parameter. For example, several researchers have noticed that, in general, first syntactic complexity in English acquisition appears in the predicate, not in the subject. In English acquisition, relative clauses appear in the predicate, before they appear in the subject (Menyuk, 1969). Coordinations also occur in the predicate before they appear in the subject (Menyuk, 1969). Early natural speech observations of these facts have been confirmed by experimental work

on children's production (e.g. Lust 1977).

These facts suggest that there is a general asymmetry in early complex sentence formation in English acquisition. This asymmetry is coherent with subject omission but not equivalent to it. According to the "pro-drop parameter," subject omission must be explained independently of these other phenomena; and the other phenomena are unexplained. In contrast, this full set of acquisition phenomena, including PSO, are consistent with the rightward setting of the PBD in English [+RB].

Finally if these phenomena regarding sentence construction do follow from the PBD parameter, and PSO is linked to this set of facts, then when PSO fails to appear in a language, so should this cluster of facts fail to appear. Our results show that in acquisition of Japanese complex sentence formation, acquisition of both relative clauses and coordination, differ critically from English.

In early acquisition of complex sentence formation in Japanese, relative clause formation is not first preferentially in the predicate, as it was in English. Subject relatives are productive (Harada, 1976, Hakuta, 1981, Snyder in preparation). In addition, both natural speech and experimental studies have confirmed that coordinate structures are not first in the predicate in early Japanese, as they were in English. Subject coordinations are productive. (Lust, Wakayama, Snyder & Bergman, 1983, Lust & Wakayama, 1979, 1981) In several cases, subject position is preferred for complexity formation by the Japanese child.

These data suggest that because Japanese is LB, the Japanese child, unlike the English child, productively develops leftward complexity even when forced to reduce overall utterance complexity by an initial performance constraint. Leftward complexity in Japanese may productively include the sentence initial subject.

Thus, the presence or absence of PSO in early first language acquisition appear to be linked to a number of other facts of early language which appear to be related to a configurational parameter, not to a pro-drop parameter.

V. CONCLUSIONS

In conclusion, we have argued as follows. (1) The preferential subject omission phenomenon found in English acquisition is linked to performance factors. It is also linked to a wide array of acquisition facts regarding early sentence formation.

(2) This whole set of acquisition facts can be linked to an alternative parameter setting for the grammar of the language being acquired.
That is, it is configurationally right in English.

(3) Not only does preferential subject omission not replicate in a LB language, i.e. Japanese, but the whole set of syntactic facts does not. (In fact, it is in part reversed). These results confirm that the preferential subject omission phenomenon in English <u>is</u> part of a more general configurational asymmetry which characterizes languages. We have suggested that a configurational parameter like PBD may capture this asymmetry.

(4) Our Japanese results also call into question the universality of the unmarked [+pro-drop] setting of this parameter, if PSO is

critical evidence for this parameter-setting.

These results do not in themselves disconfirm the pro-drop parameter or its role in acquisition. They do not vitiate the need to critically test the theoretical and empirical predictions made by this proposed parameter and unmarked parameter-setting. However, they do suggest that the critical empirical data which has been used to date to argue for the role of the pro-drop parameter in acquisition, (i.e. subject omission in English acquisition) may have an alternative explanation.

In general, these acquisition results appear to be in accord with current linguistic results, regarding Japanese in particular, and the pro-drop parameter in general. Although Japanese has been argued by some to be [+pro-drop],(e.g. Hasegawa, 1984), Japanese does not have verbal agreement with subjects or objects, which would license pro-drop. Thus, agreement in Japanese cannot insure recoverability of the null subject as it does in Italian. For this and other reasons, the generalizability of the 'pro drop' parameter to languages like Japanese is questionable in itself.

In addition, several recent linguistic proposals have argued that the 'pro-drop' phenomena are in fact a reflex of more basic linguistic facts, i.e., that they are themselves derivative of other parameters which are related to a language's configuration (Huang, in preparation, Safir to appear).

If these proposals are confirmed, then independent results from linguistic theory and acquisition results are now converging.

REFERENCES

Bloom, L. (1970). Language Development: Form and Function in Emerging Grammars. Cambridge, MA: The MIT press.

Bloom, L., Lahey, M., Hood, L., Lifter, K. & Fiess, K. (1980). Complex sentences: Acquisition of syntactic connectives and the semantic relations they encode. Journal of Child Language, 7, 235-261.

Bowerman, M. (1973). Early Syntactic Development: A Cross-Linguistic Study with Special Reference to Finnish. Cambridge: Cambridge University Press.

Braine, M. (1976). Children's first word combinations. Monographs of Society for Child Development, 41 (1, serial no. 164).

Chomsky, N. (1981). Lectures on Government and Binding. Dordrecht: Foris.

Chomsky, N. (1982). Some Concepts and Consequences of the Theory of Government and Binding. Cambridge, MA: MIT press.

Guilfoyle, E. (1984). The acquisition of tense and the emergence of lexical subjects in child grammars of English. The McGill working papers in linguistics, 2, 1, 20-30.

Hakuta, K. (1981). Grammatical description versus configurational arrangement in language acquisition: The case of relative clauses in Japanese. Cognition, 9(3), 197-236.

Harada, K. (1976). Acquisition of relative clauses: a case study on a two-year-old. Annual Reports, vol.1, Japan: The Division of Languages, International Christian University.

Hasegawa, N. (1984). On the so-called "Zero-Pronouns" in Japanese. Unpublished manuscript. University of Massachusetts at Amherst.

Huang, C-T. J. (in preparation). Pro drop in Chinese: A generalized control approach.

Hyams, N. (1983). The acquisition of parameterized grammars. Unpublished doctoral dissertation. City University of New York.

Lust, B. (1977). Conjunction reduction in child language. Journal of Child Language, 4 (2), 257-287.

Lust, B. (1986). Introduction. In B. Lust (Ed.), Studies in the Acquisition of Anaphora: Defining the constraints. Vol.1. (3-106). Dordrecht: Reidel Press.

Lust, B. & Chien, Y-C. (1984). The structure of coordination in first language acquisition of Mandarin Chinese: Evidence for a universal. Cognition, 17, 49-83.

Lust, B. & Wakayama, T. (1979). The structure of coordination in children's first language acquisition of Japanese. In F. Eckman and A. Hastings (Eds.), First and Second Langauge Acquisition (134-153). Rawley, MA: Newbury House Publishers.

Lust, B. & Wakayama, T. (1981). Word order in first language acquisition of Japanese. In P.S. Dale and D. Ingram (Eds.), Child Language: An International Perspective (73-90). Baltimore: University Park Press Publishers.

Lust, B., Wakayama, T., Snyder, W, & Bergmann, M. (1983). Comparative studies on the first language acquisition of Japanese and English. Language universal and language-specific constraints. In S. Hattori and K.Inoue (Eds.), Proceedings of the 13th International Congress of Linguistics (1131-1135). Tokyo, Japan.

Menyuk, P. (1969). Sentences Children Use. Cambridge, MA: The MIT press.

Noji, J. (1979). Yojiki no gengo seikatsu no jittai. [Description of a child's natural speech]. Hiroshima, Japan: Bunka Hyooron Shuppan.

Safir, K. (to appear). Comments on Wexler and Manzini: On parameters in the lexicon. In T. Roeper and E. Williams, Parameter Setting. Dordrecht: Reidel.

Snyder, W. (in preparation). Grammatical and processing factors in the first langauge acquisition of embedding in Japanese. Unpublished doctoral dissertation, Cornell University, Ithaca, N.Y.

Van Riemskijk, H. & Williams, E. (1986). Introduction to the Theory of Grammar. Cambridge, MA: The MIT press.

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AT THE CROSSROADS OF PHONOLOGY AND DISCOURSE: STRUCTURE AND FUNCTION IN A ONE-YEAR-OLD'S CONDUITES D'APPROCHE.

Kurt Queller
Stanford University

It is a commonplace observation that very young children tend to spend a lot of time repeating the same word over and over, often with substantial variation in form. From the work of Keenan (1977), Greenfield (1979), Scollon (1976) and others, we've gained an appreciation of the important pragmatic and proto-syntactic functions served by such self-repetition sequences. Scollon has also commented on their potential phonological significance, but this aspect of the phenomenon has received considerably less systematic attention.

In the present paper, I will show that careful study of phonological structure across discourse sequences can in fact provide important clues about how the young child's phonological system is organized, and particularly about how to handle the problem of massive formal variation in a systemic context. Even more importantly, from the perspective of the current shift toward cognitivism in child phonology, such analysis provides concrete and otherwise unobtainable evidence for the thesis that the young child behaves as an active phonological strategist and system-builder. I will argue that the child's phonological behavior in discourse reflects an ability to flexibly and resourcefully exploit available phonological options, in the service of both short-term and long-term functional objectives. These include not only the servicing of immediate communicative needs, but also the construction and progressive elaboration of a phonological system - conceived in the first instance as a set of structured output routines for the articulation of words.

By way of demonstration, I'll present analyses of three self-repetition episodes, uttered by a single child in the course of a single observation session. The child, named "Timmy", is one of the ten first-born monolingual children observed longitudinally by the Stanford Child Phonology Project. At the time of the audio- and videotape recordings on which the present analysis is based, Timmy was sixteen months old, and had an active vocabulary of somewhat more than thirty words.

In what follows, I will briefly introduce the model of early child phonology and the style of phonological description used in this study, with specific examples drawn from my analysis of Timmy's overall corpus of word-tokens for the present session. (A fuller discussion, based, like the present study, on an exhaustive analysis of all word-tokens uttered during the session, occurs in Queller, in prep.) Having thus sketched out the essential structure of Timmy's system, I will then offer analyses of three of his self-repetition sequences, showing how he both exploits and elaborates upon his phonological system in the context of discourse.

From the work of Waterson (1971), Vihman (1976), Macken (1979), Menn (1978, 1983), Ferguson & Farwell (1975) and others, we now know that such phonological patterning as exists in one-year-old speech is to be found primarily at the whole-word level. The sort of whole-word patterning characteristic of children at this early age can often best be described in terms of syntagmatically structured output classes, which the child uses to organize her small but growing lexicon for easy storage and retrieval.

The most cogent general formulation of how the structure of these early, output-oriented systems can be conceived is to be found in Menn's (1983) "motor programming" framework. Each time a young child pronounces a word, according to Menn (1976), she is in effect selecting and implementing one from among a set of articulatory "word recipes". This term simply refers to the child's inventory of established motoric routines for saying words. Structurally, a child's recipe for any given word may be relatively unrelated to the rest of the recipes in her inventory, in which case it may be thought of as a "phonological idiom" (Moskowitz, 1970). More frequently, a given child's word recipes are related to each other in terms of a set of recurring ingredients, which Menn (1978) has called "articulatory subroutines".

Timmy is a child whose whole-word phonology happens to show very little "idiomaticity", in the above sense; virtually the entire set of his word recipes can be defined, at base, in terms of a small and tightly interconnected set of articulatory subroutines. Each of his basic subroutines, moreover, can be understood as a very simply patterned sequence of "melodic" variations (or more often, of non-variation) on a single articulatory parameter, such as "nasal vs. oral resonance", or "labial vs. non-labial place of articulation". These "melodies" spread in an orderly way over the domain of the entire word, regardless of the word's length.

There are two methods of phonological description which permit systematic treatment of word-level "melodies", in this sense. One, associated with the Firthean school of "prosodic" phonology, is represented in the developmental arena primarily by the work of Waterson (1971). The other is the version of generative phonology which allows for "autosegmentalized" lexical representations, in which phonological features are specified on their own articulatory "tiers", at levels distinct from that of the segmental core (Goldsmith, 1979; van der Hulst & Smith, 1982). In the present discussion, I will use a style of notation now widely familiar from the extensive work currently being done in the latter vein. This is essentially a matter of expository convenience; it is not my purpose here to argue for the necessity of an autosegmental treatment, or for the greater "psychological reality" of this, as against other forms of representation.*

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* The conceptual framework used here is actually closer in some respects to that of Firthean prosodic phonology than to that of autosegmental generative phonology. This is because I am concerned

Each independent articulatory parameter may thus be represented as a distinct autosegmental "tier", and each of the child's subroutines is represented as a "melody" (either monotonic or complex) upon its respective tier. Figure 1 shows the set of articulatory subroutines which together define the basic parameters of Timmy's whole-word phonology. There are three types of core syllable structure, represented here as three CV-skeletons, respectively mono-, di- and trisyllabic, with open syllables and with in each case an optional prothetic vowel and/or other laryngeal element, which does not directly affect the word's meaning or structural syllabicity. There are three mutually independent consonantal tiers, with a total of seven melodies. (Note that "Palatal" here refers to articulations

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primarily with generalizations over an inventory of essentially static lexical representations, rather than with the kinds of item-and-process generalizations which are the primary focus of generative phonological descriptions. ("Subterfuge modifications" [infra] are the closest thing here to item-and-process, and even these are quite different in nature from ordinary generative "rules".) The main reasons for using an autosegmental style of representation here are (a) to characterize as simply as possible the inventory of motoric gestures (articulatory subroutines) constitutive of the child's basic set of output schemas for words, (b) to show how certain otherwise apparently anomalous forms are, in fact, better understood as systematically deformed versions of ordinary schemas, and (c) to elucidate the possible role of such deformations in the gradual expansion and differentiation of the system as a whole. I will not be concerned here with controversies over such things as the criteria for treating a feature as "autosegmentalized", or the nature and role of conventions for associations among tiers. (For some discussion, see Queller, in prep.)

I should, however, point out one crucial respect in which the present approach diverges from both Firthean and generativist assumptions. The representations of articulatory word recipes proposed here are not claimed to directly reflect the child's "underlying", perceptually-based representations of words, either on a basis of equivalence (with output form more or less directly reflecting input representation, à la Waterson) or through the mediation of a set of consistently applied realization rules (à la Stampe, Ingram or Smith). Instead, I assume that word recipes are independently specified in the lexicon, one or more for each item in the child's active vocabulary. The type of phonological patterning which concerns me here accordingly involves relations within this set of output lexical representations or word recipes, rather than between output form and other levels of representation. (For justification of such a "split lexicon" approach in early child phonology, see Vihman (1982), Menn (1983) and Queller (in prep.); see the latter also for a more explicit and exhaustive analysis of the data set upon which the present study draws, as well as for my specific views on the relations between input representations and output forms.)

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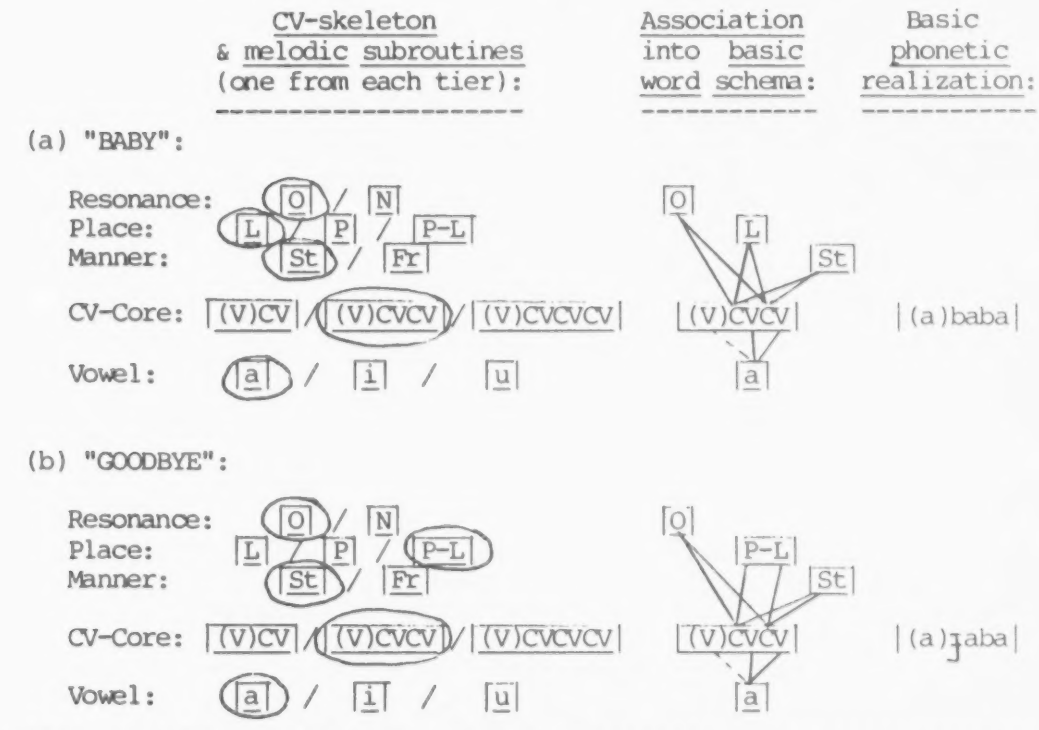
is almost the same, but instead of a monotonic Labial melody on the place tier, it uses the complex Palatal-Labial melody. The two components 'Palatal' and 'Labial' map onto the two onset consonants in a one-to-one fashion, and necessarily in that order. This is shown in **Figure 2b.** The usual phonetic realization of this schema is [(a)ʃaba] (- a form which is used consistently for GOODBYE, and sometimes also for TAPERECORDER and FLOWERS).

Fig. 2: Timmy's word recipes for "BABY" and "GOODBYE":
- consistent selection of one simple basic word schema.



Two further basic word schemas, |(a)mama| and |(a)ɲama|, are realized when the Nasal rather than the Oral melody is selected for the resonance tier, while retaining everything else as in Figure 2(a&b). (These are the schemas for Timmy's words MOMMY and SIMON, respectively.) In contrast, note that the schemas *|(a)baʃa| and *|(a)maɲa| are "ungrammatical" for Timmy at this stage. Within the present descriptive framework, this fact corresponds to the non-existence of any *[Labial-Palatal] melody on the Place tier. Timmy currently has only one articulatory subroutine for dealing with Palatal and Labial consonants within a single word, and it requires that they be articulated in that order, whatever the other structural characteristics of the word may be. (See Vihman, 1976, Macken, 1979 and Menn, 1978 for discussion of similar phenomena.)

Timmy's word FLOWERS is more complicated, but the same principles are involved. Figure 3 illustrates the schematic structure of this word. Evidently, he has not settled on a single, consistent word recipe for FLOWERS; his forms for the word vary over no fewer than four of his basic word schema options. These four options are defined by systemic alternations at several levels within the inventory of basic subroutines. Figure 3a shows that, in the overall recipe for FLOWERS, there is a two-way alternation at each of three levels: the

Fig. 3. FLOWERS: Structurally, a case of schema conflict.

|(a)ʃaba| ~ |(a)zaβa| ~ |(a)baba| ~ |(a)ɸ a|

(a) Melodic subroutine alternations.

Resonance [O] / [N]

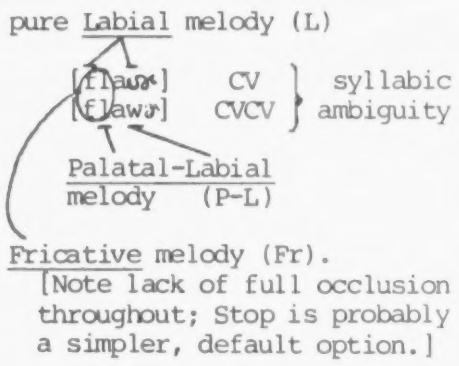
Place [L] / [P] / [P-L]

Manner [St] / [Fr]

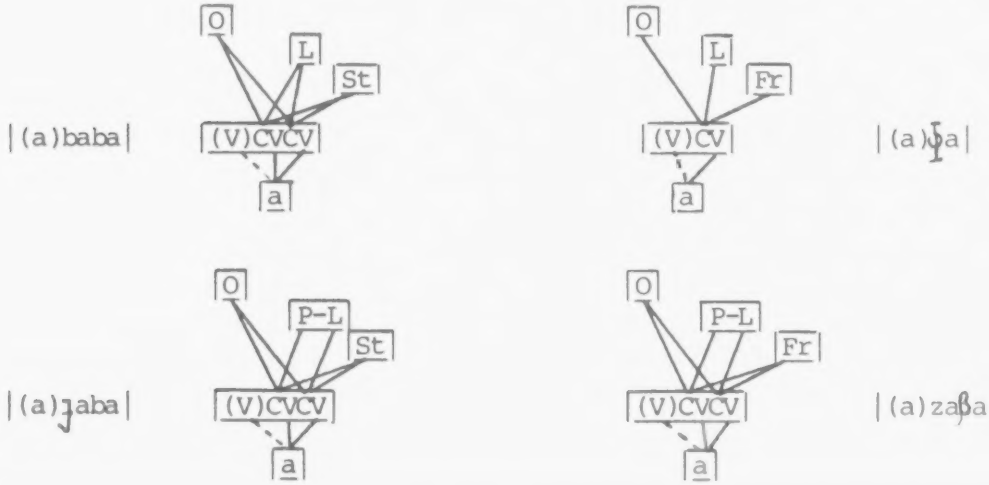
CV-core [(V)CV] / [(V)CVCV] / [(V)CVCVCV]

Vowel [a] / [i] / [u]

(c) Relationship of alternating melodies to gestalt features of target word.



(b) Internal structure of the four basic word schemas underlying Timmy's versions of FLOWERS.



CV-core, the place tier, and the manner tier. This yields eight theoretically possible schematic variants for FLOWERS; the structures of the four which actually occur are shown in **Figure 3b**.

If we compare some of the alternating melodies with selected features of the target word FLOWER(S), as in **Figure 3c**, we find that Timmy's choice of melodic alternants is far from random. Each schematic option captures a slightly different subset of a larger set of features, which we may presume to be somehow characterized within Timmy's input phonological representation of the word.

What we have here is a clear case of the well-known phenomenon which Garnica and Edwards (1977) have called phonological "trade-off". Ferguson (1985) has observed that this phenomenon ordinarily reflects "schema conflict" within the child's phonological system. That is, the child has available several whole word schemas, each of which can accommodate certain parts of a larger set of target features, but no single form can express them all at once.

This formulation in terms of conflicting phonological output schemas very aptly characterizes the nature of the structural constraints which underlie formal variation of the type we see in the FLOWERS example. What I want to argue here is simply that the child's relationship to these constraints must be viewed as that of an active phonological strategist. Not only does he react to structural constraints; he also creatively exploits his available systemic options. Good evidence for this claim is to be found in discourse.

The case of Timmy's word FLOWERS is particularly nice, because all four schematic options are found in the course of a very brief discourse episode, transcribed in **Figure 4a**. The episode is basically an instance of what Scollon calls "discursive repetition". This is the familiar pattern in which the child repeats a word over and over, trying in a variety of ways to get the listener to "cue in" to and acknowledge the intended referent. The means which Timmy employs to that end in the present case, I would claim, can be characterized in an active sense as a strategy of "phonological schema <u>shifting</u>". Let's see specifically how this works in the FLOWERS episode.

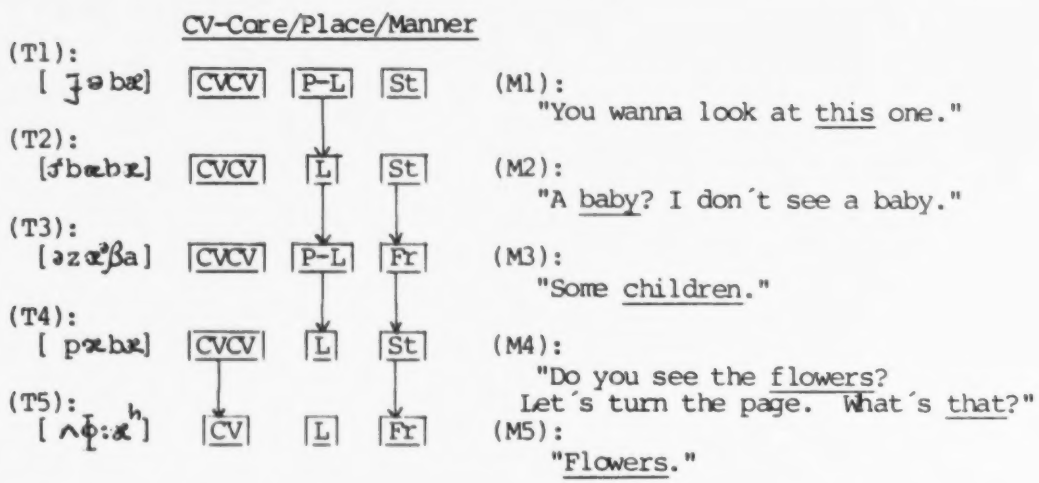
Notice, in Figure 4a that each time mother makes a guess, Timmy switches one or two of the three basic structural parameters which are susceptible to variation within his overall articulatory "recipe" for FLOWERS. The value of each of Timmy's word tokens on each of these parameters is noted in the transcript, so that one can trace the internal structure of his schema shifting, from one token to the next. Except for the token at (T4), which represents a reversion to the schematic structure used at (T2), each repetition gives a different schematic rendition of the same word, each time providing the listener with a slightly different combination of clues to the overall structure of the target word. The phonological shifts help to carry part of the general pragmatic "meta-message" which is characteristic of discourse-motivated repetition, and which can be paraphrased roughly as follows: "I'm not sure you're cueing in to what I'm saying yet. Listen again."

Additional evidence for the strategic character of this episode of schema shifting can be found in the methodical, even elegant manner

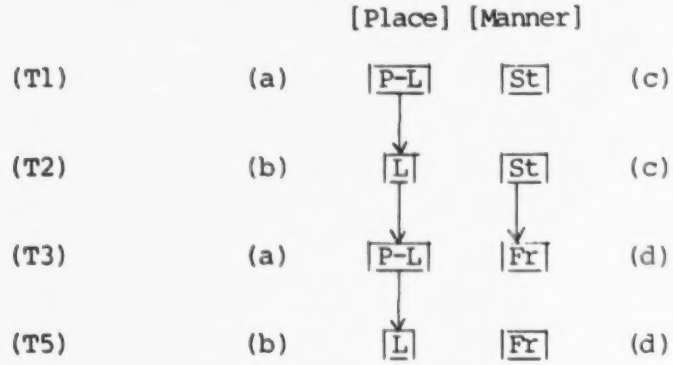
in which the sequence of shifts proceeds. Let us subtract the schematic repetition at (T4) from the sequence, as shown in **Figure 4b**, and consider only the four schematically distinct tokens. Focusing in now on the sequence of melody-switching on the two consonantal tiers, where the bulk of the variation occurs, we can see that Timmy's side of the episode is formally characterized by an almost poetic kind of overall sequential patterning. Such methodical structuring of the overall discourse sequence provides additional evidence that the child is not simply letting his tongue slip from pattern to pattern, but is instead actively manipulating his available phonological options.

Fig. 4. The FLOWERS episode: functionally, a case of schema shifting.

(a) The episode, with Timmy's variants of FLOWERS characterized for three basic word schema parameters showing alternations for this word.



(b) Patterning in the sequence of melody-switching on the two consonantal tiers (with the schematic repetition at (T4) subtracted).

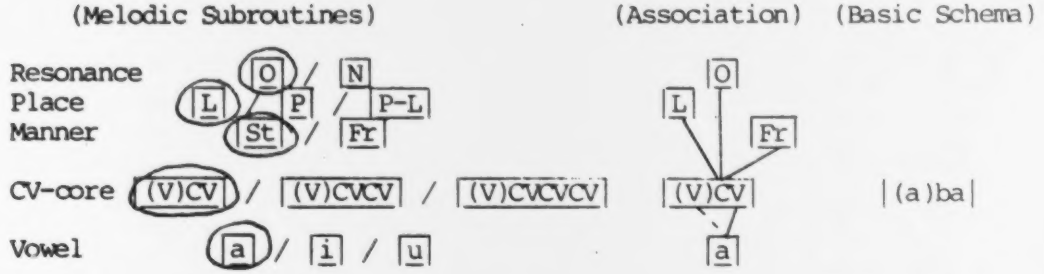


"Schema shift" is not the only phonological strategy which Timmy can be found exploiting in discourse. A second kind of strategy, which I call "subterfuge modification", is represented for example by his four partially distinct forms for the word BALLOONS:

(a) [(a)ba:--] (b) [(a)bai] (c) [(a)bai:--] (d) [(a)baji]

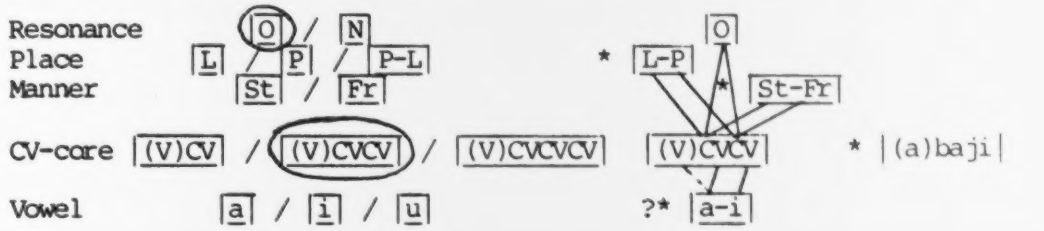
These, I will argue, are all versions of a single basic schema, represented in Figure 5. That we are not dealing here with a series

Fig. 5. Timmy's basic recipe for BALLOONS: a single basic word schema which underlies all of his variant forms for the word.



of shifts across distinct schematic categories can be demonstrated most clearly with reference to form (d): [baji]. (See Figure 6.)

Fig. 6. Problems in trying to analyze [baji] ("BALLOONS") as a direct product of Timmy's system of basic word schema options:



Phonetically, [baji] is disyllabic, with a medial voiced palatal fricative. Any attempt to analyze it as such within Timmy's system of basic word schemas, however, yields a structure which is quite irregular, containing three complex melodies which we had not posited as belonging to the inventory of basic subroutines. The vocalic tier shows an offgliding Low-High sequence [a-i]; there is some motivation for accepting this as an emerging unit within Timmy's inventory of basic melodies, as we'll see later. The complex melodic patterns

"Labial-Palatal" and "Stop-Fricative", however, have no independent structural support anywhere else in Timmy's whole-word phonology.

Structurally, the variant forms for BALLOONS are better accounted for with reference to a closely-knit set of simple modificatory processes, for which there is substantial independent support elsewhere in Timmy's whole-word phonology. These modificatory processes can be represented as a series of deformations which occur specifically at the level of the CV-core, within a given schema. In effect, they constitute an additional set of articulatory subroutines, operating at a secondary level within the overall system, distinct from (and superimposed upon) that of the basic melodic subroutines. In terms of the "word recipes" metaphor, one might think of them as sauces and seasonings: they're frequently optional, and occasionally obligatory, yet they never constitute a "dish" by themselves.

In order to get a sense of how these modificatory routines work, we need to play around for a moment with another set of metaphors: those in terms of which we habitually think of segmental structure in phonology. The kinds of images which underlie our conception of the sequence of segments (or CV slots) in a word are, I suggest, of the following sort: the fixed number of discrete and more or less uniform pearls in a necklace, of links in a chain, or of candies in a roll of Lifesavers. For present purposes, at least, I would propose that they be visualized instead as points along a stretch of some more elastic substance, such as a roll of clay or silly-putty. What makes a roll of clay different from a roll of Lifesavers is that it can be stretched or pinched at any number of points along its length, so that certain of its sections become longer and/or narrower than others.

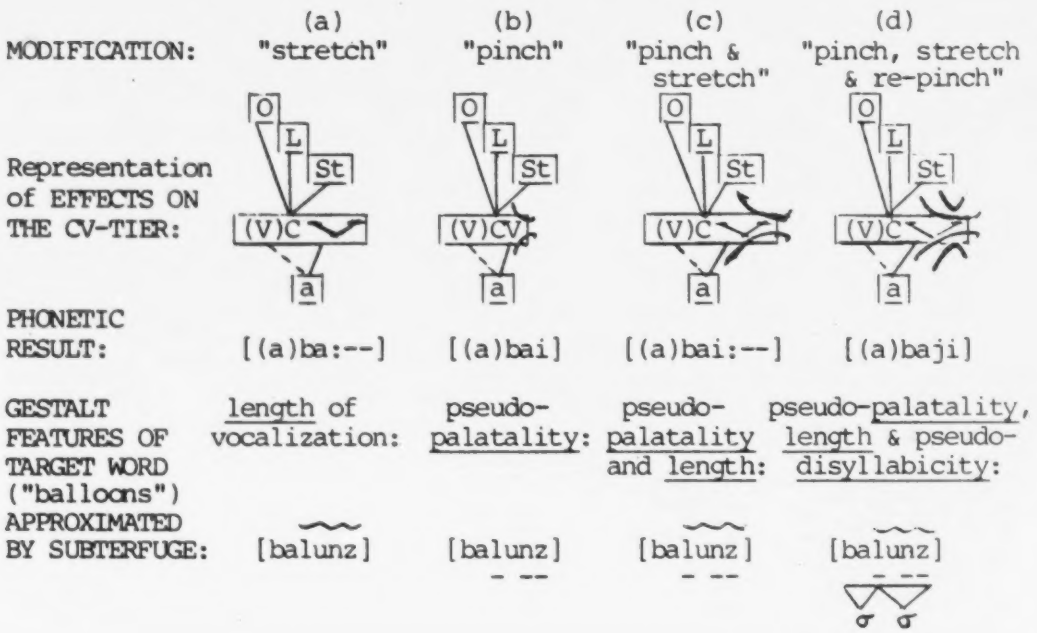
I would claim that some roughly analogous set of articulatory devices underlies quite a number of Timmy's words tokens. Figure 7 shows specifically how articulatory stretching and pinching work to produce his variant forms of BALLOONS.

We begin, in each case, with the same basic word schema: |(a)ba|. The featural melodies on the various tiers remain unchanged throughout. The changes all take place at the level of the CV-core; in the present case, they all focus on the the tail end of the vocalic element. In form (a) [ba:—], This element is simply stretched, without any further deformation, and the phonetic result is that of a prolonged vowel. In form (b) [bai], the same part of the CV string is pinched in such a way that the vocal tract is narrowed at that point, producing the phonetic effect of a palatal offglide. We represent this iconically with a pair of curved lines "pinching" the CV skeleton (or roll of clay) at the appropriate point.

Form (c) [bai:--] shows one way in which stretching and pinching can be combined, with the phonetic effect of a prolonged palatal offglide. Finally, when a form like that in (c) gets re-pinched at a point before the end of its palatal offglide portion, we get (d) [baji], with the phonetic effect of an intrusive palatal glide or fricative yielding to a high front vowel.

None of these child forms provides an astoundingly good match to the target word "balloon", but all of them are better than [ba]. In fact, scanning across the bottom of Figure 7 from left to right, one

Fig. 7. Timmy's four versions of BALLOONS as subterfuge modifications within a single basic word schema.



can see that the more the form is modified away from the idealized schematic version |(a)ba|, the greater the number of gestalt target-word features it incorporates. Form (a), with simple lengthening, mimics at least something of the overall length of "balloon", while the palatal offglide in (b) reflects the fact that the prominent second syllable of "balloon(s)" includes in its consonantal elements a lot of what Timmy usually expresses as palatality. Form (c) combines these global features of length and palatality in one word-form. The same is true of (d) which, in addition, even manages to reflect something of the disyllabicity of "balloon(s)".

These structural observations strongly suggest that strategic motives may be involved when the child moves from less modified forms (as in (a) and (b)) to more modified forms (as in (c) and (d)). The goal of such a move, just as in schema shifting, would be to accommodate as many target-word features as possible, while working within the set of options and constraints imposed by the output system. In the present case, the child does this not by shifting across word schemas, but by engaging in a kind of strategic phonetic subterfuge within a chosen schema. It is on the basis of considerations like these that I subsume structurally defined modificatory processes such as "stretching" and "pinching" under the more general, functionally oriented rubric of "subterfuge routines".

Before accepting modification of schemas by subterfuge routines

as a new kind of phonological strategy, however, we would like to see some evidence that the child actually does deploy them strategically. Again, the best way to find such evidence is to look at the distribution of forms in discourse.

Figure 8 shows the beginning of a somewhat longer self-repetition episode involving BALLOONS. Like the FLOWERS episode, the present discourse refers to illustrations in a picture book. In this case, however, there is no serious doubt about the reference of Timmy's remarks. What is of primary interest, for present purposes, is his response to the two attempts by his interlocutors to shift the topic of conversation away from that of "balloons", which he has himself established at (T1). The attempted topic shifts are marked by the arrows in the transcript.

Fig. 8. The BALLOONS episode: subterfuge modifications in the service of discourse objectives.

(T1) [bʌ·i] BALLOONS [pinch].
(pointing to balloons.)

(M1) "Balloons.
-▸ -Is this a boy? Can you say 'boy'?
Boy." (pointing to boy on same page.)

(T2) [bʌi] ?BALLOONS / 'BOY'?
(pointing where mother has just pointed.)

(M2) "Yes." (whispered; turns page.)

(T3) [ʔbai:--] BALLOONS [pinch & stretch].
(pointing to balloons on new page.)

(M3) "Balloons."
(O1) "He's got a lot of balloons.
-▸ Does he have a teddy?" (pointing.)

(T4) [ʔbæji] BALLOONS [pinch, stretch & re-pinch].
(pointing to same place as at T3.)

(M4) "Balloons." (turns page.) ...

At (M1), we see mother acknowledging Timmy's initial utterance by repeating: "Balloons". But then, noticing the similarity between Timmy's simple pinched version of BALLOONS and the sound of the adult word "boy", she immediately points to the boy in the picture and says "Is this a boy?", trying to get him to say that word.

At (T2), Timmy makes at least a passing gesture of acquiescence; he points where she has just pointed, and again says [bʌi]. It remains rather unclear whether this token counts for him as an imitation of "boy" or as a repetition of BALLOONS. There is no evidence anywhere else in the data of "boy" being an item in Timmy's active vocabulary.

What is clear is that a bit of phonetic / semantic confusion has been introduced. Timmy's forms for BALLOONS at (T3) and (T4) serve to

counteract this potential confusion, as well to parry a second attempt at topic shift. Structurally, he has switched from his relatively less modified previous form to more strongly modified and less ambiguous forms. [Compare form (b) vs. forms (c) & (d) in Figure 7.]

Here, then, is another strategic use of phonological options in the service of a pragmatic objective. Whatever other, purely phonological functions such subterfuge variation may have, here we see that it, like schema shifting, may also be used to convey the meta-message which is typical of what Scollon calls "discursive" repetition - essentially: "This is what I'm talking about; don't you see?"

The distinction which Scollon (1976) made between "discursive" and "phonological" functions of self-repetition in one-year-old speech is not a strictly dichotomous one; many episodes, he claims, simultaneously serve both kinds of function. The schema-shifting pattern of Timmy's FLOWER sequence provides a rather clear example. While giving the listener clues to the child's communicative intent, the shifts in form across such sequences probably also reflect the child's search for a suitable recipe for the word, in terms of which he might regularize and systematize his pronunciation of it, for more efficient storage and retrieval.

The following episode is slightly different; it is an example of purely phonological repetition. I propose that careful analysis of episodes of this sort can yield evidence for a rather strong and interesting claim: that the child's experimentation within his set of systemic options may actually serve to open up new, previously unavailable systemic options, thus allowing the child to elaborate and expand his phonological output system "from within". Scollon (p. 100) suggested that this was the essential function of phonological repetition; however, in a study primarily devoted to the discourse foundations of early syntax, undertaken at a time when there existed no descriptive framework really adequate to the task of analyzing one-year-old phonology, he was unable to provide detailed support for the claim. In a recent review of the arguments for a cognitivist approach to phonological development, Macken and Ferguson (1984) reaffirm the need to find data on the role of active experimentation on words in the building of children's phonological systems; however, they lament the relative scarcity of such data in material examined to date.

Again, part of the problem is that we, as phonologists, often pay too little attention to what happens across sequences of utterances in discourse. In the following, I'll attempt to show how systematic variation of a word's form across stretches of self-directed discourse may indeed help the child to expand his output system from within. Specifically, I claim that subterfuge modification of basic word schemas, constructed according to a narrowly delimited inventory of articulatory subroutines, provides the child with a basis for extending the inventory itself. This may be done in such a way that the child adds new elements (viz., new basic melodic subroutines) to the inventory, but without ever going outside the constraints of the inventory in its original, more restricted form.

The episode in question involves a word of extremely high token

frequency for the present session: Timmy's word for LIGHT. Often throughout the session, Timmy looks fondly over at the lit-up recording equipment and utters variations on the forms |(a)ɟa| and |(a)ja|, which his mother glosses quite consistently as LIGHT. In the present scene, he actually toddles over to the tape-recorder, where he sits down with his back to both mother and observer. While carefully re-adjusting the recording equipment, he utters the self-directed discourse transcribed in **Figure 9.**

Forms (T2) - (T9) are all variations on his word for LIGHT. The "recipe" for all of them contains the same basic schema, except that there is a shift from Stop to Fricative on the manner tier. This can be seen by comparing the first and last tokens of LIGHT ((T2) & (T9)). Looking at the intervening sequence of repetitions, however, we can see quite clearly that the present schema shift is mediated by a whole series of forms, all of which reflect various patterns of subterfuge modification to the input schema seen initially at (T2).

The details of how this happens are included for reference in the transcription, but the the gist of the matter is summarized in **Figure 10.** Essentially, what he's doing is stretching and pinching the initial prothesis element, in such a way that the main syllable onset consonant is also affected. (See the middle part of the Figure.) As the consonantal portion gets pulled into the prolonged, mushy palatal transition which now intervenes between the onset of phonation and the primary vowel at the end, its melodic specifications "float", and the ballistic articulatory effects of the stretching and pinching take over. At (T3) and from (T5) onward, the pinched prothesis rebounds toward the main syllable vowel with something like an intrusive palatal glide or fricative; in most of the forms, moreover, this "rebound" element effectively replaces the previous, fully occlusive onset consonant. As the stretching is gradually reduced, the consonantal portion re-emerges from the palatal mush - but now with a Fricative rather than a Stop value on the manner tier. (See the right-hand part of Figure 10.)

In short, subterfuge in this case constitutes the means by which Timmy manages to break out of one basic schema and into another. Now, if all of Timmy's word tokens containing Fricative melodies could be shown in this way to be products of subterfuge modifications within other, more basic schemas, we could entirely eliminate the manner tier Stop / Fricative contrast from the set of parameters to be specified in basic word schemas, thus achieving a much simpler basic inventory of subroutines. (This would be equivalent to the set represented in Figure 1, except that the manner tier would be entirely eliminated.) In fact, though, a sizable proportion of his Fricative tokens show no alternant forms with Stop articulation, and no evidence of having been methodically "built up to", over a series of repetitions. The discourse evidence as a whole thus suggests that Timmy has access to Fricative articulations by both routes, often directly selecting a schema that comes specified with a Fricative melody, but sometimes taking the long way around, via subterfuge modification.

Multiple ways of accessing the same material may seem needlessly redundant in terms of descriptive economy, but from the point of view

Fig. 9. The LIGHT episode: Repetition in the service of purely phonological considerations.

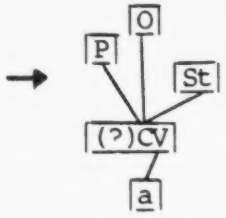
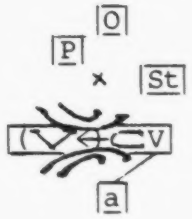
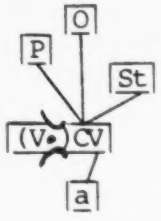
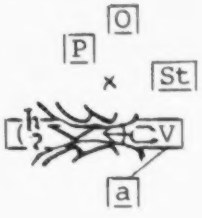
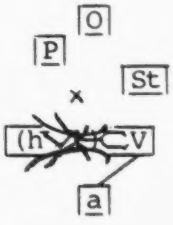
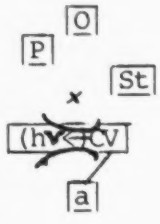
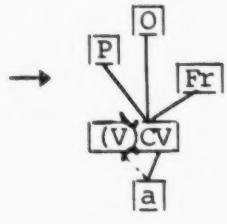
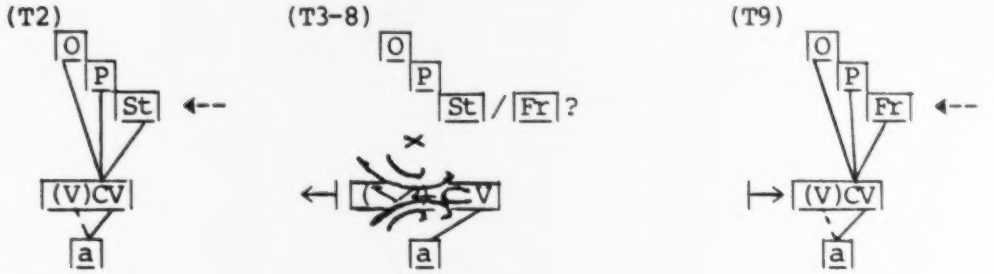
Phonetic form:	Word schema (w/ subterfuge modifications indicated as deformations of CV-Tier):	Gloss:
(T1) [agaɬga]		[Protoword form, sometimes used for "TAPERECORDER"]
(T2) [ʔgɑ:ʰ]		"LIGHT"
(T3) [aⁱɕⁱjæ]		"LIGHT"
(T4) [aᵻjæ]		"LIGHT"
(T5) [heɣˢɣᶻja] (T6) [ʔɪʃɾʃɾja]		"LIGHT"
(T7) [hɾɟ:jæ]		"LIGHT"
(T8) [hija]		"LIGHT"
(T9) [aijæ]		"LIGHT"
(T10) [akŋgŋ]		[Preferred babble form]

Fig. 10. Simplified representation of how **subterfuge modifications** (Stretching & Pinching) are used to effect schema shift ([St] -> [Fr]) in the LIGHT episode.



Entry as basic Monosyll. / Oral / Palatal / Stop schema

- |(a)ja|

"LIGHT"

SUBTERFUGE within this schema. (Stretching and pinching of prothesis, with coinvolvement of the main syllable onset consonsant; autosegmental melodies are "floated", as the ballistic effects of subterfuge take over.)

Re-emergence as new basic schema (Monosyll. / Oral / Palatal / Fricative).

- |(a)ja|

"LIGHT"

of on-line linguistic processing, such redundancy is indispensable. Peters (1983), in her monograph on the units of language acquisition, reviews various kinds of evidence for the claim that acquisition of syntactic fluency requires a capacity for "fusing" what are originally complex production routines into single, immediately accessible performance units. The schema-shifting-via-subterfuge-modification pattern seen in episodes such as the LIGHT sequence may very well represent part of an analogous phonological process, whereby laboriously derived word forms gradually get fused into structural entities which are accessible as basic performance units. Under certain circumstances, new units of this sort would become susceptible to structural reanalysis in terms of the child's system of articulatory subroutines - in some cases, as new basic melodies.

Translating this on-line processing perspective into an explicitly longitudinal, developmental one, this amounts to a claim that something like what we've represented as an autosegmentalized manner tier, with its Fricative melodic option, is actually in the process of emerging within the system, as Timmy gradually reinterprets the phonetic output of his subterfuge routines in terms of his basic schema inventory. This developmentally emergent character of the manner tier could be represented by the use of parentheses in our list of the elements constituting the basic inventory, as in Figure 11.

A similar scenario is probable in the case of the offgliding [a-i] vowel sequence resulting from pinching. Figure 12 shows how forms

Fig. 11. Extended inventory of basic melodic subroutines.

Tiers:		Melodies:
Consonantal Tiers:	Resonance:	ORAL / NASAL
	Place:	LABIAL / PALATAL / PALATAL-LABIAL
	(Manner:	STOP / FRICATIVE) *
Core syllable structure:	CV-core:	(V)CV / (V)CVCV / (V)CVCVCV
Vocalic Tier:	Vowel quality:	a / i / u / (a - i) *

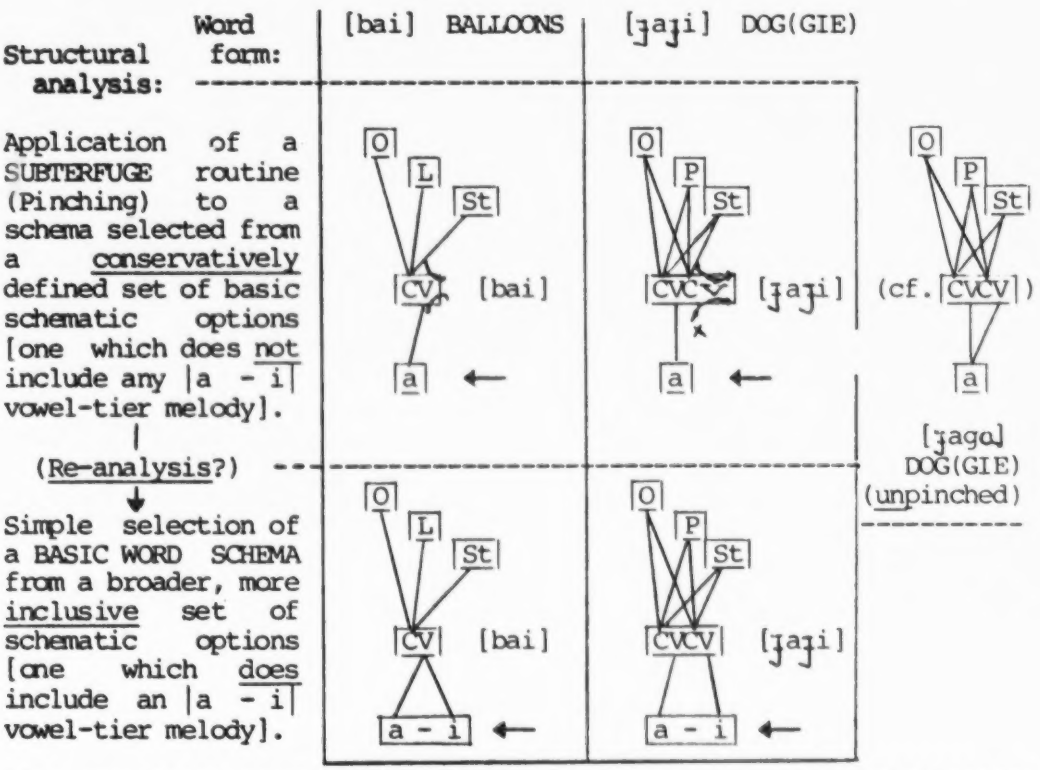
* Parentheses ( ) enclose Tiers and Melodies assumed to be currently emergent within the inventory of basic schema options, via re-interpretation of forms originally derived by application of modificatory SUBTERFUGE routines.

such as [bai] for BALLOONS and [jaji] for DOG(GIE) are structurally ambiguous between a pinching interpretation and an alternative interpretation involving a basic [a-i] melody on the vowel tier. The former interpretation assumes only the restricted set of melodies used thus far. The latter interpretation implies a structural reanalysis of pinched forms with palatal offgliding vowel sequences in terms of an extended set of basic melodic subroutines, such as in Figure 11.

Further longitudinal analysis is needed, of course, in order to determine to what extent experimentation in discourse actually does serve as a means by which children elaborate their phonological output systems from within. However, I would maintain that even longitudinal data cannot be fully exploited without careful attention to the child's phonological behavior in discourse. For example, we may well find [a-i] vowel sequences attested for Timmy at times both prior and subsequent to the present session, but with fundamental differences in structural status. Just as in the case of syntactic construction, examination of structure across sequences of utterances in discourse may provide the crucial evidence regarding how construction has occurred, in each case.

Figure 13 provides a summary of how the various structural and functional parameters discussed above interact across the three episodes. Both the FLOWERS and the BALLOONS sequence contained indications that the repetition was in some considerable part motivated by familiar discourse factors, involving such things as the need to resolve referential ambiguity, or to establish (or maintain) a particular discourse topic. The phonological strategy Timmy employed in the FLOWERS episode was that of shifting across his set of whole-word output schemas. In the BALLOONS episode, he resorted to a

Fig. 12. Structural ambiguity of |a - i| vowel sequences in selected tokens of 'BALLOONS' and 'DOG(GIE)' (modificatory SUBTERFUGE vs. basic SCHEMA SELECTION):



different kind of phonological strategy: a kind of "subterfuge" which allows him to modify the output form of a word, while remaining within the same basic schema. The two strategies correspond to two distinct structural levels within the output system as a whole, as indicated on the right side of Figure 13. (There is no necessary correlation, however, between the structural character of the strategy and the function which it serves in any particular instance.)

The LIGHT sequence illustrated in a rather pure way how self-repetition can be used for intrinsic phonological purposes. These purposes, I would claim, involve two related subgoals: (a) the discovery, establishment, fine-tuning and re-ajustment of articulatory word recipes for items in the active lexicon, and (b) the internal elaboration and realignment of the phonological output system itself. In the LIGHT sequence, these phonological functions were subserved by a complex combination of the two types of strategy already described, in such a way that the one (subterfuge) was itself used as a means for achieving the other (schema shift). I have suggested that the two strategies interacted here in the way they did because Timmy was

Fig. 13. Summary of the structural & functional characteristics of each of the three self-repetition episodes.

Episode:	Predominant function served by repetition:	Phonological strategy involved:	Level of the phonological output system involved:
FLOWERS	"DISCURSIVE" (& PHONOLOGICAL?)- [establishment of joint reference]	SCHEMA SHIFT (across schemas)	Primary level of BASIC WORD SCHEMAS (word recipes requiring only selection of CV-skeleton & basic melodic subroutines)
BALLOONS	"DISCURSIVE" (& PHONOLOGICAL?)- [disambiguation of reference & maintenance of discourse topic]	SUBTERFUGE MODIFICATION (within a single schema)	Secondary level of MODIFICATORY SUBROUTINES (at which complex word recipes are derived from more basic ones)
LIGHT	PHONOLOGICAL - [establishment & readjustment of word recipes for lexical items; elaboration of output system as a whole]	Both, with SUBTERFUGE MODIFICATION leading to SCHEMA SHIFT	BOTH levels at once (fusion of a secondarily derived recipe into a basic one, with re-analysis in terms of a new inventory of output schema options available at the primary level)

fusing a derived word recipe into a simpler, unitary one, which he could then reinterpret in a way that would contribute to the diversification of his inventory of basic output schema options.

Throughout this discussion, I've said next to nothing about an issue which has been central to much previous work in child phonology - that of characterizing the so-called "transduction rules" which mediate between the child's input phonological representations for words and his output forms. I have preferred instead to focus on the output system itself as an independent level. As a concluding note, I'd like to say just one thing in favor of a frank output-system bias. The issue of how transduction relationships get established in early child phonology is extremely important, but it's also more problematic than commonly assumed. Even when we find regular correspondences between adult and child forms, the evidence that the child is literally applying modificatory processes to derive an output from an auditorily-based input representation may remain quite circumstantial.

(This is partly because neither the child's input representations nor the cognitive structures or processes which relate them to the child's output forms are accessible to direct observation.) I submit that, if we want to demonstrate clearly that the child actually subjects phonological representations to some kind of real-time modification process for some strategic purpose, there is no better way than to actually observe how the child modifies one kind of output-level representation into another, across actual stretches of discourse. By doing that, we may in fact come to learn all kinds of new and interesting things about how the child goes about building and continually reorganizing that rather less directly observable kind of entity that we call a phonology.

BIBLIOGRAPHY

Ferguson, C.A. (1985) Discovering sound units and constructing sound systems: It's child's play. In J. Perkell & D. Klatt (eds.), Invariance and Variability of Speech Processes. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Ferguson, C.A. and C.B. Farwell (1975) Words and sounds in early language acquisition. Language, 51:419-439. Also in W. S.-Y. Wang (ed.), The Lexicon in Phonological Change. The Hague: Mouton (1977).

Garnica, O. & M.L. Edwards (1977) Phonological variation in children's speech: The trade-off phenomenon. Ohio State University Working Papers in Linguistics, 22:81-87.

Goldsmith, J. (1979) The aims of autosegmental phonology. In D. Dinnsen (ed.), Current Approaches to Phonological Theory. Bloomington: Indiana University Press.

Greenfield, P.M. (1979) Informativeness, presupposition, and semantic choice in single-word utterances. In E. Ochs & B. Schieffelin (eds.), Developmental Pragmatics. New York: Academic Press.

Keenan, E.O. (1977) Making it last: Uses of repetition in children's discourse. In S. Ervin-Tripp & C. Mitchell-Kernan (eds.), Child Discourse. New York: Academic Press.

Macken, M.A. (1979) Developmental reorganization of phonology: A hierarchy of basic units of acquisition. Lingua, 49:11-49.

Macken, M.A. and C.A. Ferguson (1984) Cognitive aspects of phonological development: Model, evidence and issues. In K.E. Nelson (ed.), Children's Language, Vol. 4. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Menn,L. (1976) Pattern, control and contrast in beginning speech. Doctoral dissertation, University of Illinois. Circulated by Indiana University Linguistics Club.

Menn, L. (1978) Phonological units in beginning speech. In A. Bell & J.B. Hooper (eds.), Syllables and Segments. Amsterdam: North Holland Publ. Co.

Menn, L. (1983) Development of articulatory, phonetic and phonological capabilities. In B. Butterworth (ed.), Language Production, Vol. II. London: Academic Press.

Moskowitz, B.A. (1970) The acquisition of phonology. Working Paper No. 34, Language Behavior Research Laboratory, University of California, Berkeley.

Peters, A.M. (1983) The Units of Language Acquisition. Cambridge: Cambridge University Press.

Queller, K. (in prep.) Exploration with syntagmatic routines in the young child's construction of phonology. Unpublished doctoral dissertation, Stanford University (Department of Linguistics).

Scollon, R. (1976) Conversations with a One-year-old: A Case Study in the Developmental Foundations of Syntax. Honolulu: University of Hawaii Press.

Van der Hulst, H. and N. Smith (1982) An overview of autosegmental and metrical phonology. In H. van der Hulst & N. Smith (eds.), The Structure of Phonological Representations (Part I). Dordrecht: Foris Publications.

Vihman, M.M. (1976) From pre-speech to speech: on early phonology. Papers and Reports in Child Language Deveopment, 12:230-43.

Vihman, M. (1982) A note on children's lexical representations. Journal of Child Language, 9:249-53.

Waterson, N. (1971) Child phonology: A prosodic view. Journal of Linguistics, 7:179-211.

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Color Word Acquisition: Conceptual or Linguistic Challenge

Nancy N. Soja

Massachusetts Institute of Technology

Many researchers have noted children's incredible facility in learning new words and have used this facility to draw conclusions about the process of word learning (Brown, 1970; Carey & Bartlett, 1978; Katz, Baker, & Macnamara, 1974; Markman & Hutchinson, 1984, Nelson & Bonvillian, 1973; Ovaitt, 1982). This paper examines the converse -the difficulty children experience in learning certain words, color words.

Mabel Rice (1980) has demonstrated that many children who do not know any color words do not easily learn a word that refers to a color. She used operant conditioning to teach children to say "red" and "green" correctly to red and green objects. The children needed an average of 796 trials to learn to respond appropriately.

This difficulty is striking when compared to the skill that children who know color words have in learning a new color word. Heibeck and Markman (1986) have shown that children who know color words make an initial mapping of a new color word after hearing it only twice. Furthermore, Carey and Bartlett (1978) have shown that this "fast mapping" happens equally well with children who know only one other color word and children that know nine or more other color words.

The two results just described --the difficulty in teaching a first color word and the ease in teaching subsequent color words-- suggest that children face an obstacle when learning words in a new conceptual domain, at least in the color domain. The focus of this paper is identifying the obstacle in the color domain. The question is: is the problem perceptual, conceptual, or linguistic?

The source of the obstacle could not be perceptual discrimination. Bornstein, Kessen, and Weiskopf (1976) have demonstrated that at four months infants can discriminate colors and appreciate at least some of the color boundaries that adults perceive. Infants have perceptual color categories. Therefore, young children must face either a conceptual obstacle or a linguistic obstacle to learning their first color word.

What could a conceptual obstacle be like, given that infants have perceptual color categories? The answer is based on the difference between perception and conception. The significant thing about concepts is that they are the basis for inductive inferences. In order to use color in inductive inferences, color must be perceptually available; however, that perceptual availability does not guarantee conceptual status. It could be that the conceptual system of a child who does not know color words is constrained such that color is never considered as a basis for inferences even though it is discriminated. This kind of constraint would prevent children from hypothesizing color to be the referent of a word and will be called the conceptual obstacle.

An alternative hypothesis is that the obstacle is purely linguistic. Children may be capable of using color in inductions, but

not in inductions of word meaning. In other words it could be that color is not a nameable concept at an early point in word learning. This kind of constraint will be called the linguistic obstacle.

Mabel Rice (1980) and Linda Smith (1984) have independently attempted to determine which obstacle (conceptual or linguistic) is functioning and both argued for a conceptual obstacle. They found that the children who had difficulty on color word tasks also had difficulty on nonlinguistic tasks requiring inductions based on color. To decide between the two hypotheses it is imperative that children who know no color words be compared with children who know one or more color words. However, neither Rice's procedure nor Smith's procedure divides children this way. That is, Rice's subjects were bilingual, but their knowledge of color words was only assessed in English. They may have known color words in another language. Smith's experiment was not designed to discriminate children who knew no color words from children who knew only a few color words. Therefore, the Rice (1980) and Smith (1984) experiments leave open the question of whether children who do not know color words use color in any inductions.

The following experiments address that question. Children were tested for their linguistic and conceptual knowledge of colors. The linguistic task revealed exactly the number of color words known. The conceptual tasks necessitated the use of color. There were also control tasks that were structurally similar to the color tasks but did not depend on color. These tasks were used to compare the relative effects of the children's representation of color with their understanding of other aspects of the task.

In sum, in order to support the conceptual obstacle hypothesis, it must be shown that there is a task that depends on inductions based on color that cannot be done by children who know no color words, and yet can be done by children who know even just one color word. Also, it must be shown that the difference between the children is not due to task-related demands that are independent of color. In contrast, to support the linguistic obstacle hypothesis all the children must be able to do the conceptual tasks. This result would demonstrate that children who know no color words can use color in inductive inferences. In this case a second question arises: do children who know color words do better on nonlinguistic color tasks than children who do not know color words? It could be that children who do not know color words have a representation of color and yet the learning of color words makes color even more available for inductive inference.

EXPERIMENT 1

Method

Subjects

In the main task there were 12 subjects who knew color words and 12 subjects who did not. The mean age was 2 years, 1 month (range: 1:11 - 2:4) and 2 years exactly (range: 1:10 - 2:2), respectively. 24 different subjects (12 who knew color words and 12 who did not) were given a control task. The mean ages were also 2:1 and 2:0. Half the subjects in each group were male and half were female.

Procedure and Stimuli

The subjects were first tested for their knowledge of color words. Then half of the subjects were given a task that necessitated the use of color. The remaining subjects were given the control task. The control was very similar to the color task except that color was not a relevant factor.

Knowledge of Color Words

Knowledge of color words was assessed in a comprehension task. The eleven colors selected by Berlin and Kay (1969) as the basic colors (red, blue, green, yellow, purple, pink, orange, brown, white, black, grey) were represented with pieces of construction paper and crayons. They matched the focal color for each color as determined by Heider (1971).

Five or six colors of one medium (paper or crayon) were placed in front of the subject (S). The experimenter (E) asked questions of the form, "Can you find the red paper/crayon?" about each color. Then the remaining five or six colors were presented and the procedure was repeated. At this point each color had appeared exactly one time. Then, the whole process was repeated. In the second run, the colors were grouped and arranged differently than in the first run and the other medium was used. This procedure resulted in each color being presented and selected by the experimenter twice. If the subject chose the red one, for example, both times that the experimenter asked for it and not more than one other time (in a run) when a different color was correct, then the subject was credited with knowing the word "red". If a subject knew even one color word, then he was placed in the "know color words" group. To be placed in the "do not know color words" group a subject had to fail on all color words.

Nonlinguistic task -dependence on color

There were eight pairs of small objects. In each pair the two objects differed only in color (Figure 1).

Figure 1

For example, one pair was two strollers, one purple and one orange. The other pairs are listed in Appendix 1. The E showed the S both objects of a pair and let the S choose one. The E then said "This is your stroller. This stroller is yours. And this is my stroller. This stroller is mine" pointing appropriately. They then played with their own toys for a short while. The E continued to use the phrases "your stroller" and "my stroller" as dictated by the play. The E then put the strollers side by side and asked the S "put your stroller in this bag". The S's visual contact with the objects was briefly interrupted before the objects were presented for the test question. The sides of the S's and E's toys were counterbalanced. The eight trials were preceded by a practice pair consisting of a red bureau and a yellow cup.

Control Task -no dependence on color

There were 8 pairs of objects. The two objects within a pair were

identical (e.g. two purple strollers were used). Seven of the object types were the same as the first seven objects in the color task in the first color listed for each. The eighth object type was a green dog. The procedure was the same as in the color task until the E took both objects. In the control task each person put his object down in front of himself. Then the E asked either "put your stroller in this bag" or "put my stroller in this bag." Each question was asked in four trials in a random order. The reason for the difference in procedures is as follows. The toys had to remain near the owners spatially to be kept distinct. Since the position of the objects was biasing, it was necessary to ask the S to choose the E's toy in half of the trials. The purpose of the control was to determine knowledge of possession words and it achieved this goal.

Results

All subjects did better than chance on both tasks (Figure 2).

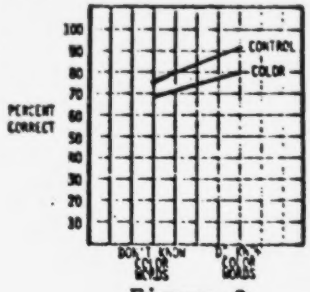

Figure 2

The performance of the subjects who knew color words was 80% on the color task (t (22) = 4.719, p < .0002, 2-tailed) and 93% on the control task (t (22) = 7.754, p < .000002, 2-tailed). The performance of the subjects who did not know color words was 69% on the color task (t (22) = 2.989, p < .01, 2-tailed) and 75% on the control task (t (22) = 4.449, p < .0005, 2-tailed).

A two-way ANOVA comparing knowledge (know color words x do not know color words) X task (color x control) revealed a knowledge main effect only (F (1, 44) = 6.041, p = .018, 2-tailed). There was no main effect of task (F (1, 44) = 2.494, p = .121, 2-tailed) and no interaction between task and knowledge of color words (F (1, 44) = .345, p = .56, 2-tailed).

In sum, all the subjects could do both tasks. The subjects who knew color words did better than the subjects who did not know color words, but this benefit did not depend on the task.

Discussion

The first question asked was: do children who do not know color words use color in any inductive inferences? To do the color task correctly, the subjects had to select color for coding in their representation of the object. And they had to use it as the basis of their inferences about ownership. Subjects who know no color words succeeded. Therefore, color is conceptually available for them, at

least as a specification of an individual object.

The second question was: do children who know color words do better than children who do not know color words on nonlinguistic color tasks? The advantage had by subjects who knew color words was not specific to the color task. Therefore, their advantage must be due to their knowledge of possessive words rather than their ability to represent color. Possibly children who know color words are more verbally advanced than children who do not know color words in a variety of linguistic domains.

However, there was a problem with the comprehension task. Some of the subjects appeared to have no understanding of the task and refused to complete it. These subjects were scored as not knowing color words. But, it could be that they did know one or more color words and raised the mean of the "do not know color words" group. To solve this problem a new comprehension task was designed that all the subjects enjoyed and understood.

Experiment 2 used a new conceptual task, as well as the new comprehension task. In the new conceptual task, the E chose one object and the S was expected to choose an object that was the same as the E's out of two alternatives. As in Experiment 1, the subjects needed to compare a mental representation of the target object with their representation of two objects being visually presented (Figure 3).

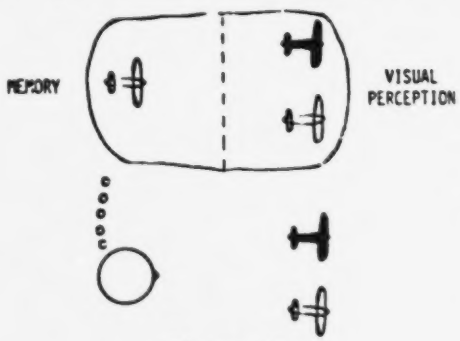

Figure 3

EXPERIMENT 2

Method

Subjects

There were 24 subjects. 12 subjects knew color words and 12 did not. 6 of the subjects in each group were male and 6 were female. The mean age was 2:0 (range: 1:11 - 2:3) for the subjects who did not know color words and 2:1 (range: 1:10 - 2:3) for the subjects who did know color words. Three additional subjects were dropped because they did not reach the criterion of the training task. One subject knew color words and two did not.

Procedure and Stimuli

The subjects were first tested for their comprehension of color words. They were then given two training tasks and the nonlinguistic task requiring color.

Knowledge of Color Words

In this comprehension task felt bags replaced the papers and crayons. Each bag had a toy inside. Again, five or six bags of different colors were presented to the S. The E said, "These are bags and there is a toy in each bag". The E showed that one of the other bags opened and had a toy inside. The E then said "Can you find the toy in the red bag". Again, each color was presented twice. The same criterion for assessing whether the child knew one or more color words was used as in Experiment 1.

Truck Training

The E and the S played with a truck and some blocks. After a short free-play period the E put one block on one part of the truck and asked the S to do the same. The E corrected the S if the S put the block in a different place. They played this game until the S learned to follow the E's actions without feedback. At that point the E said "Let's play this game with some other toys," and the second training began.

Second Training Task

This procedure is a modified version of the follow-the-leader procedure used by Smith (1984). The E presented four objects (Figure 4). The objects are listed in Appendix 1.

Figure 4

She put two in front of the S and two in front of herself. The E's two objects were different from each other with respect to kind, shape, size, and color. The S's pair was identical to the E's pair. The E then selected one object and put it in an open box and said, "You put one of your toys in here". The correct toy was the one that was identical to the toy the E had chosen. Although the verbal command did not specify the correct toy, the truck training set up a context in which the S knew to do the same thing that the E had done. In this training task there was no feedback concerning the correct choice. After the subject chose one toy, the E began the next trial without correction. However, if the S chose both toys, the E put all the toys back in their original positions and said, "See, I'm leaving this toy here and putting this toy, just this toy, in the box. You take one toy, just one of them, and put it in the box. Leave one toy there".

There were eight trials. If the S chose the correct toy in six or more of the trials, the E continued the game with the toys from the task that required inductions based on color. Otherwise the subject was dropped. Three subjects were dropped: one knew color words and two did not. The sides of placement were counterbalanced such that the correct response was equally distributed on the subject's left and right sides.

Task Requiring Inductions Based On Color

The procedure in this task is identical to the procedure of the second training task. In fact, the subjects experienced the two tasks as one continuous game. The difference between the tasks was in the

relationship between the objects (Figure 5).

Figure 5

The E's two objects differed in color, but were otherwise identical. The objects are listed in Appendix 1. The S's object pair was identical to the E's, as in the second training task. The correct toy was the one of the same color as the toy chosen by the E. Again feedback was only given when the S chose both objects.

The second training task is training for this task (the color task) because it is structurally similar, yet is easier because the selection of the correct toy can be made on the basis of many different factors. The training task is also a control in that the S needed to use color to choose correctly in the color task but not in the training task.

Results

The subjects were significantly better than chance on both kinds of trials (Figure 6).

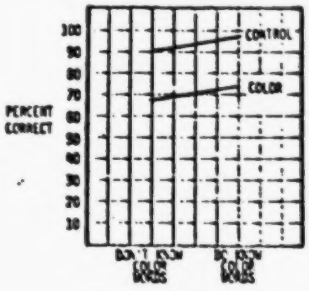

Figure 6

The subjects who knew color words did 98% of the control trials correctly (t (11) = 35.605, p < .0000002, 2-tailed) and 74% of the color trials correctly (t (11) = 3.936, p < .005, 2-tailed). The subjects who did not know color words did 90% of the control trials correctly (t (11) = 13.323, p < .0000002, 2-tailed) and 68% of the color trials correctly (t (11) = 2.068, p = .034, 1-tailed).

A two-way anova comparing knowledge (know color words x do not know color words) X trial type (control x color) revealed a trial type main effect only (F (1, 22) = 16.713, p < .0005, 2-tailed). There was no main effect of color word knowledge (F (1, 22) = 1.459, p = .24, 2-tailed). There was no interaction between trial type and color word knowledge (F (1, 22) = .08, p = .78, 2-tailed).

On the comprehension test, the chance of a subject who knew no color words in getting one color word right was .18. There were two subjects in the "know color words" group who only got one color word correct. It is possible that they, in fact, did not know any color

words; and that they masked differences between the two groups by lowering the means on the control and color tasks. However, this possibility is not a real problem because the two subjects performed at the higher end of the range of scores for their group.

In sum, the subjects were better than chance on both kinds of trials. The color trials were harder than the control trials, but this result is somewhat artificial because the subjects who did worse than 75% on the control trials were dropped. There was no difference in performance between the subjects who knew color words and the subjects who did not know color words.

General Discussion

The major result of Experiment 1 (that color is available to children who do not know color words) was replicated in Experiment 2. Subjects who knew no color words selected color for representation and used it as the basis of their inferences about ownership and similarity. These data rule out the conceptual obstacle hypothesis and support the linguistic obstacle hypothesis. Children need to learn that names can refer to colors.

What sort of reasonable linguistic constraint would inhibit the learning of certain kinds of words? Below are two examples of the kind of constraint that could be functioning.

The first is that children only lexicalize properties that have functional relevance. Various properties, like object-type, size, and ownership, determine what you can do with an object. Color, on the other hand, has very little functional relevance for most objects. Although children do use color to specify objects, as has just been shown, the color itself rarely determines what can be done with the object. Color is not embedded in a rich explanatory structure. One possible constraint, in sum, is that only functionally relevant properties are lexicalized.

The second possible linguistic constraint is proposed by Landau and her colleagues (Landau & Gleitman, 1985; Park, Tsukagoshi & Landau, 1985). They suggest that children believe that property words refer to relative properties as opposed to absolute properties. In the color domain, light and dark are relative properties. For an object to be light it must be relative to a standard that is darker or another object that is darker. In contrast, a color can be red without being compared to any other colors. This constraint, then, is that only relative properties are lexicalized.

However, an alternative argument is that the conceptual obstacle has not been rejected. To do the tasks children needed, minimally, to have an integral representation of color. That is, they could have made a wholistic comparison of the objects rather than a feature-by-feature comparison. However, to learn color words, children need to represent color independently from any particular object. These experiments were a first pass at investigating the conception of color had by children who do not know color words. More research needs to be done to see whether, in fact, they have a separable representation of color.

Given that children who do not know color words can base some inductions on color, the second question raised in the introduction

must be addressed. That is, do children who know color words do better at nonlinguistic color tasks than children who do not know color words? The answer in these experiments is no. The advantage due to knowledge in Experiment 1 was the same regardless of the relevance of color and there was no advantage in Experiment 2. However, there may be other nonlinguistic color tasks that do favor children who know color words.

In conclusion, it should be emphasized that the linguistic constraints described above are not maladaptive. Objects, hypothetically, can be characterized by an infinite number of features and relations. If the range of possible word meanings were not constrained, children would never learn a single word. By constraining the kinds of referents a word can have, children are able to learn thousands of words in a few years. However, these constraints may inhibit the acquisition of certain kinds of words, like color words. The examination of these negative effects as well as the positive effects will enlighten our understanding of knowledge acquisition and representation.

References

Berlin, B., & Kay, P. Basic color terms: Their universality and evolution. Berkeley: University of California Press, 1969.

Bornstein, M. H., Kessen, W., & Weiskopf, S. Color vision and hue categorization in young human infants. Journal of Experimental Psychology: Human Perception and Performance, 1976, 2, 115-129.

Brown, R. Linguistic determinism and the part of speech. In R. Brown (Ed.), Psycholinguistics. New York: The Free Press, 1970.

Carey, S., & Bartlett, E. Acquiring a single new word. Papers and Reports on Child Language Development, 1978, 15, 17-29.

Heibeck, T. H., & Markman, E. M. Word learning in children: An examination of fast mapping. Manuscript submitted for publication, 1986.

Heider, E. R. "Focal" color areas and the development of color names. Developmental Psychology, 1971, 4, 447-455.

Katz, B., Baker, G., & Macnamara, J. What's in a name? A study of how children learn common and proper names. Child Development, 1974, 45, 269-273.

Landau, B., & Gleitman, L. R. Language and experience. Cambridge: Harvard University Press, 1985.

Markman, E. M., & Hutchinson, J. E. Children's sensitivity to constraints on word meaning: Taxonomic versus thematic relations. Cognitive Psychology, 1984, 16, 1-27.

Nelson, K. E., & Bonvillian, J. D. Concepts and words in the 18-month-old: Acquiring concept names under controlled conditions. Cognition, 1973, 2(4), 435-450.

Oviatt, S. L. Inferring what words mean: Early development in infants' comprehension of common object names. Child Development, 1982, 53, 274-277.

Park, S., Tsukagoshi, K., & Landau, B. Young children's mis-naming of colors. Poster presented at the meeting of the Society for Research on Child Development, Toronto, April 1985.

Rice, M. Cognition to language categories: Word, meaning and training. Baltimore: University Park Press, 1980.

Smith, L. B. Young children's understanding of attributes and dimensions: A comparison of conceptual and linguistic measures. Child Development, 1984, 55, 363-380.

APPENDIX 1

Materials

Experiment 1	Experiment 2	
	Control/Training	Color Trials
strollers (purple orange)	Indian figures and dinasours	high chairs (orange pink)
bears (pink blue)	tops and plastic grids	chickens (yellow green)
planes (red green)	dogs and bottles	balls (orange purple)
hangers (yellow pink)	curlers and rubber jar openers	trucks (blue yellow)
shovels (red blue)	shoes and hair brushes	horses (red green)
cribs (orange green)	chess pieces and handles to peelers	spoons (blue purple)
keys (blue yellow)	chairs and cups	combs (pink green)
hair brushes (green purple)	plastic semicircles and radish flowerers	men (red blue)